

POPULAR Computing WEEKLY

10 June 1982 Vol 1 No 8

30p

BBC Paintbox

Reviews: Mazogs

ZX81 keyboard
tone

The Fast One

Defining your
own characters

More on Spectrum colour



ZX HARDWARE....

PROFESSIONAL 40 KEY KEYBOARD

- All legends and graphics in 2 colours
- No soldering to ZX81, just plug in
- Proper typewriter keys
- RAM/Printer compatible

Kit £19.95 Built £24.95 Case £10.20

Repeat key add on TBA

Range of in/out ports, music boards, motherboards, D to A converter boards. Write for catalogue

23 way double sided, gold female edge connector, wirewrap type £2.95

Male connector £1.25

Ribbon cable £1.40 per metre

Mastering Machine code book £5.50

Programming for real applications £6.50

Tape for real applications £11.25

HARRIS & LOCKYER ASSOCIATES

(Sole distributors for Redditch Electronics)

Dept PW
33 Pedmore Close
Woodrow South
Redditch
Worcs
Tel: (0527) 24452

Prices include VAT + P&P
Overseas add £1.80 postage
Delivery 3 days for in stock
items else allow 28 days
Send SAE for Free Catalogue
Official orders welcome

SIR

COMPUTERS

8 bit input/output port
for Sinclair Spectrum

4 channel analogue
input for Joystick

Please write or phone for details:

38 Danycoed Road
Cyncoed
Cardiff

0222-759 015

ZX80

JRS SOFTWARE

ZX81

19 WAYSIDE AVENUE, WORTHING, SUSSEX BN13 3JU Telephone: WORTHING 65861 (Evenings and Weekends only)

CASSETTE professionally recorded by SOUND NEWS STUDIOS

£4.95

GAMES PACK — Best this for value 5 x 16K programs PLUS 2 x 1K programs.

(\$9.95)

3-D Battle (McCode-1K) — First moving space battle with continuous count down of enemy units left.
City Bomb (McCode-1K) — Destroy the buildings and land your plane. Your fuel has nearly gone and you circle the city tower and tower.
Warp Wars (Basic and McCode-16K) — Features realistic space craft moved by M code for instant response. (Previously sold at Microfair with Sweet Tooth for £4.95.)

Sneak (Basic-16K) — A game of thought and skill. Pass through all the marked squares without crossing or doubling back on your path, but watch out for the expanding black blob. (Previously Microfair for £3.95.)

Sweet Tooth (Basic and McCode-16K) — M code routines used to move your fat face round the screen and gobble the sweets.

PLUS Galton and Black Holes. (Previously sold together for £4.95.)

An ESSENTIAL addition to your 1K RAM ZX81 (or ZX80 8K ROM)

TOOLKIT (written by PAUL HOLMES). Provides the following additional facilities:

Line number — you state starting number and increment value. Search and replace — changes every occurrence of a character as you require. Free space — tells you how many free bytes you have left.

SPECIAL GRAPHICS ROUTINES

Hyper graphics mode — graphics never seen on a ZX81 before. Open — instantly sets up as many empty print lines as you require. (1K version only.) Fill — used in conjunction with Open fills your screen instantly with your specified character. Reverse — changes each character on your screen to its inverse value.

TAPE ROUTINE — provides a system WAIT condition until a signal is received in the cassette ear jack — many uses. All these routines are written in machine code and together make up only 16K BYTES of your precious RAM, an incredible achievement. The price is incredible, too! Only £3.95 (\$7.90) for cassette, including FULL instructions and example programmes. ALSO available 16K version only £4.95 (\$9.90) which includes all the above. PLUS GOTTS and GÖTTES included in-line number. Search for and list every line containing specified character.

16K VERSION

NEW GRAPHICS TOOLKIT. (Another masterpiece by PAUL HOLMES)

22 exciting MACHINE CODE routines that give you control over your screen as never before! (ZX81 — 16K RAM ONLY)

DRAW/UNDRAW draws or erases your multi-character shape which is defined in a REM statement. You may define as many different shapes as you like and draw or undraw each at will at whichever screen position you choose.

FORGROUNDOFF On/off use this to protect existing characters on your screen. When on new shapes will appear to slide behind and re-emerge from other shapes.

BORDER UNORDER Draws a border round the edges of your screen area. Edit lines can be used if required. Your border is protected when foreground is on.

FILL Fill any number of lines you specify, starting at any line you specify, by your chosen character.

REVERSE Converts all characters to their inverse codes, control as in FILL.

PRINT POSITION CONTROLS

UP } After your next PRINT position in the direction indicated

DOWN

LEFT

RIGHT

EOITPRINT Moves next PRINT position to first edit line.

ALL FOR ONLY £5.95 (\$11.90) (savings value from JRS)

This includes a cassette with 2 copies of the program plus a comprehensive instruction booklet with examples.

NOTE: All prices are fully inclusive — send cheque or P.O. to JRS Software at above address

OVERSEAS CUSTOMERS PLEASE NOTE: Payment may be made in Sterling (Money Order available at your bank) or \$U.S. (U.S.A. customers only). Prices quoted above are also export prices and include AIRMAIL postage.

As reviewed in KILLBUTT COMPY-
TER March 1982
16K RAM PACK
£32.95 (\$59.95)
Quite simply the best available
+ FREE Alien Attack (7K-M)
codes on a cassette — value
£5.75



Uses existing power supply
(max. 600mA +)
Compatible with printer
for visible printing.
Gold-plated edge connector
for perfect contact with your
ZX81. Normally despatched
within 10 days of receipt of
your order.
AND NOW — 64K RAM PACK
Same quality to the 16K, too,
for perfect contact with your
ZX81. £82.95 (\$125).

SCROLL facilities

UPSCROLL

DOWNSCROLL

RIGHTSCROLL

LEFTSCROLL

Scroll your screen in the direction indicated

ON SCREEN-OFF SCREEN turns your screen on or off.

BACKGROUND ON/OFF Fills your screen by your specified character.

When foreground is on existing information is unaffected and shapes will appear to pass in front of your background, without deleting it.

SEARCH AND REPLACE will search the screen for every occurrence of the character you specify and replace it with your new character.

SQUARE draws a square or rectangle from your specified co-ordinates.

ALL these routines are in machine code for SUPER-FAST response! Simply load GRAPHICS TOOLKIT, which repositions itself at the end of your RAM, and then your own program (or key in a new one).

GRAPHICS TOOLKIT takes only 2K of your RAM and that includes space to load the programmers TOOLKIT described above (16K RAM version).

POPULAR Computing WEEKLY

The Team

Editor

Duncan Scot

Reporter

David Kelly [01-930 3271]

Sub-editor

Peter Harvey

Designer

Eric Robbie

Editorial Secretary

Fiona McCormick

Advertisement Manager

David Lake [01-839 2846]

Advertisement Executive

Alastair Macintosh [01-930 3840]

Publishing Director

Nick Hampshire

Popular Computing Weekly,
Hobhouse Court, 19 Whitcomb Street,
London WC2
Telephone: 01-839 6635

Published by Sunshine Publications Ltd.

Typesetting, origination and printing by
Chesham Press, Chesham, Bucks

Distributed by S M Distribution
London SW9. 01-274 8611. Telex: 261643

© Sunshine Publications Ltd 1982

Subscriptions

You can have *Popular Computing Weekly* sent to your home: the subscription rate is £19.95 per year, for addresses in the UK.

How to submit articles

Articles which are submitted for publication should not be more than 1000 words long.

All submissions should be typed and a double space should be left between each line.

Programs should, whenever possible, be computer printed.

At present we cannot guarantee to return every submitted article, so please keep a copy.

Accuracy

Popular Computing Weekly cannot accept any responsibility for any errors in programs we publish, although we will always try our best to make sure programs work.

This Week



Cover illustration by Taosam Inmat

News	5
Prompt delivery for Beeb micros	
Club Reports	7
Dave Kelly reports on the Longfield School computer club.	
Paintbox	8
Brian Reffin Smith presents some colouring painting programs.	
Reviews	10
Mezogs, keyboard audio tone.	
Open Forum	13
Seven pages of programs.	
Programming	20
Define your own BBC characters.	
Spectrum	21
Nick Hampshire continues his look at ZX Spectrum colour.	
Hand & mouth	22
Guessing roots and getting your assembler ORGANised	
Sound & vision	23
More music for your micro.	
Peek & poke	25
Your questions answered.	
Competitions	26
Puzzle, crossword.	

Editorial

When Clive Sinclair launched the Spectrum, he said, 'Delivery within 28 days.'

That was seven weeks ago.

Every day that passes more people who were counting the days to the arrival of their new computer call us up asking for help.

There is only so much we can do. We can mention here that the promised delivery dates of the Spectrum seem to have slipped.

More normally we are always willing to take up individual complaints from customers against suppliers.

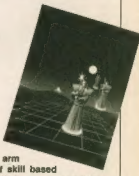
But when it comes to such a rush of complaints the responsibility necessarily has to fall back in the hands of you, the customer.

The answer is to add a clause to your order stating: 'I regard it as binding that the goods are delivered within 28 days.'

If your order and cheque are accepted so is the contract.

If the goods are not delivered, go to your Citizens' Advice Bureau, ask about the Small Claims Court procedure, and make a fuss.

Next Week



Chance your arm in a match of skill based on the ancient Japanese territorial game called GO: we call it Othello

Classified

20 SIMPLE ELECTRONIC PROJECTS FOR THE ZX81 and other computers

Make the most of your Micro-computer with this great book of construction projects. £6.45.

Available from:
National ZX Users' Club
44-48 Earle Court Road
London W8 5EJ

Please make your cheque payable to Interface.

SINCLAIR ZX81 plus big byte 16K, £82. Ring Walsingham (032672) 374.

TRS-80 4K LEVEL 1 CPU and monitor. Manuals, software. Perfect for beginner. £195. Tel: Ramsbottom 6254 after 5.30 pm.

ZX81 + 16K, books, maps and games tapes, £90. 802-71937.

ZX81 16K RAM, 5 months' old + software, £85 ono. Tel: 025-482 2060.

ZX81 — MC : INPUT — prints on screen, flashing cursor and readdata, E3. M. Whitfield, 66 Bramblebury Road, London SE16.

VIC-20 16K and cassette recorder, over £15 software, worth £310, will accept £270 ono. Tel: 0773-813351.

16K ZX81 with five tapes, 3D Adventure, etc. in good condition with manual, £90 ono. Tel: 0904-797737.

THREE ZX81 PROGRAMS (Biorhythm, Rubic Cube and Tax) on cassette with full instructions. Send £3.25 to 23 Jolliffe Road, West Wittering, Sussex PO20 8ET. Make all cheques payable to S. Hibbert.

ZX81 KITS, Inverse video £2.95; built £3.55; repeat key £3.75; built £4.95. Memory crashes and top line slant cured, £2.95. Tel: 021-444 3034.

ZX81 16K RAM GAME CASSETTES: Get Them Before your Bosses get Them! Invaders £4.95; Solve the Clues if you want to Escape! Very Nasty Mountain £6.95. Gilrope Ltd., Dept CW, PO Box 50, Rugby, Warks CV21 4DH.

ZX81 + 16K RAM PACK and software for £85. Tel: Bungey 3382.

TRS80 LEVEL 8 lower case mod fitted. Games, tapes, £220. Wickham Market, Suffolk. Tel: 0728 747241.

ZX81 (16K) machine. Sinclair built, £75. Tel: Winchester 65184 after 6 pm.

ZX81, SINCLAIR BUILT (new ROM), 16K RAM, tapes, £79. (04252) 71764.

VIC-20 plus cassette, game cartridge and magazines £180. Tel: 01-251 3769 after 5 pm.

BBC MICRO, model B with 16in colour TV, books, magazines and cassettes including 30 hour basic £550. Tel: 057 283 735.

MICROTAN 85 GRAPHICS TANEX, 8K RAM Xbug PSU £200 ono; 79 key keyboard, data encoding Eprom £30 ono. Tel: Kaniworth 58384.

SHARP PC1211 COMPUTER with printer £120 ono. Phone Barry 01-434 1365.

BBC MODEL B COMPUTER £435; Star matrix printer (Centronics Interface) £180. Noyce, 18 George Street, Brighton.

ZX81 KEYBOARD, sounder and reverse display, P.C.B. and instructions £3.50 each or SAE for details to R. Mitchell, 20 Gorse Close, Portlisle, Sussex.

SINCLAIR ZX81 plus 16K RAM plus tapes and books, very good condition, £90. Tel: 0252 317217 (evenings).

VIC-20 plus cassette unit, books. Many programs and joysticks, £260 ono. Tel: 01-692 9787.

ZX81 (16K) with books and tapes, very good condition, £85 ono. Tel: 0493 720774.

BBC MICRO: M/C Invaders, Breakout and Dodgers. All run on model A or B using sound and colour. Three programs on one cassette, £4 (inc). From: B. Cridland, 6 Bowness Avenue, Fleetwood, Lancs FY7 8PA.

ZX81 (16K) STORE/SORT PROGRAMME. Store, sort and order hundreds of items of information and amend as required. Tape and instructions, £4.95. J. Blackford, 63 Eriley Avenue, Cambridge 3.

ZX81 (16K) FREE PROGRAM. Send cassette and SAE to Nick Godwin, 4 Hurler Crescent, Eymouth, Berwickshire.

ZX81 (16K) for sale, £80, ZX81 Chess. £4. Tel: 021-773 9521.

ZX81 plus 1.2A PSU and programs, £50. Tel: Maldon (Essex) 57713.

ZX81 (16K). Immaculate condition, seven months unexpired guarantee, £90. Waybridge 48401.

ZX81. One month old, £55. Dr. Jayadev, General Hospital, Aberdare, Mid Glamorgan.

ZX81 (16K) machine. Sinclair built, £75. Tel: Winchester 65184 after 6 pm.

CLASSIFIED ADVERTISING RATES:

Line by line: For private individuals, 20p per word, minimum 10 words.

For companies, traders, and all commercial bodies, 40p per word, minimum 20 words.

Semi-display: £10 per single column centimetre, minimum length 3 cm. (Please supply A/W as PMT. Or supply rough setting instructions.)

Conditions: All copy for Classified section must be pre-paid. Cheques and postal orders should arrive at least two weeks before the publication date. If you wish to discuss your ad, please ring Alastair Macintosh 01-930 3840.

Here's my classified ad.

(Please write your copy in capital letters on the lines below.)

Please continue on a separate sheet of paper

I make this words, at per word so I owe you £.....

Name

Address

Telephone

Please cut out and send this form to: Classified Department, Popular Computing Weekly, Hobhouse Court, 19 Whitcomb Street, London WC2

Acorn clears its BBC backlog

Acorn has now cleared its backlog of orders for the BBC micro.

The company has dispatched 22,400 machines, leaving only some 5,000 orders outstanding. Production, at 6400 micros per month, should soon clear this backlog though orders are still being received at the rate of 4,000 per month.

Acorn stress that the production capacity is now well able to cope.

In addition to the much publicised production difficulties, caused by insufficient chip supply from Ferranti and, according to their spokesman, by snow in Wales, Acorn apparently misjudged both the extent and the type of demand for the machines.

The company thought, said the spokesman, that demand for the two machines, Models A and B, would be weighted towards the less expensive Model A in a ratio of about 3 to 1.

But orders favoured the Model B in about the same ratio and Acorn was not

geared to manufacture that volume of Model B machines. To solve these difficulties, and in particular to ease production capacity problems of one of the machine's manufacturers, Clearstone in Gwent (the other is ICL), Acorn has appointed a third subcontractor, WNGS, based in Hong Kong.

Although Acorn has tried to produce a wholly British-built micro, WNGS were appointed to assemble some machines for export.

Now, to reduce the backlog of orders in this country, Acorn has been importing some part-assembled micros which are then completed (and the interfaces are added) and then quality-controlled by Clearstone.

The present situation on the availability of the BBC machines is as follows:

Model A — there is no delay and delivery is guaranteed within 21 days.

Model B — an order placed now would be fulfilled by the beginning of August.

Micro sheets on offer

The BBC Computer Referral Service is offering a range of fact-sheets giving advice to micro owners.

There are five fact-sheets offering information on books, jobs in computing, micro-computers in small businesses, computers in education, and regional and national user groups.

The Referral Service, set up as an information exchange to handle letters arising out of BBC's Computer Programme, is open to all enquirers and already supplies a wide range of user information for any micro.

For any or all the leaflets, or for the address of your local club, contact BBC Computer Referral Service, Broadcasting Support Services, PO Box 7, London W3 6XJ.



Sale Of The Moment? A certain well-known computer finds its way on to that programme.

Acorn at your service

Acorn has chosen Retail Control Systems Ltd, of Middlesex, to provide a nationwide maintenance and service facility for all the Acorn micros, including the BBC Models A and B.

Retail Control Systems will operate in tandem with the 50 or so approved Acorn dealers who already provide a repair and back-up facility.



Plotting new courses for the PET... JJ Instruments' PD4.

JJ produce portable plotter for the PET

JJ Instruments Ltd has produced a new low-cost X-Y plotter, primarily for use with the PET.

Called the PD4, it's A4 sized and designed to be easily portable. It is a development of the PL4 X-Y recorder.

David Sawyer, the company's product manager, explained, that the machine accepts digital commands via an IEEE-488 interface bus making the plotter compatible, in particular, with the Commodore Pet.

JJ Instruments also supplies a software package in ROM form for use with the Pet, eliminating the programming required to command the plotter.

These commands control the pen, raising and lowering it, and provide the plotter with simple routines to, for example, draw lines between absolute or relative positions or

draw shapes and characters.

The pen is capable of responding at speeds of up to 600mm s⁻¹ and the PD4 plotter can recognise off-scale data, raising the pen, automatically.

The size and cost of the PD4 makes it useful for a wide range of applications in industry, education and commerce, and its dimensions make it particularly suited for use with a micro-computer.

The PD4 plotter plus interface costs £596, and comes complete with an instruction manual giving the setting-up procedures, guidance on its uses and sample programs. The software allowing the use of the PD4 with the PET costs an additional £65.

Both the PD4 plotter and software are available from: JJ Instruments Ltd, Brook Avenue, Warrash, Southampton SO3 6HP.

What a Bleep-ing good idea!

If you have ever become infuriated by the touch keys on the ZX81, Fulcrum Products now offers a small unit that is designed to help.

It is called the ZX Bleep. When fitted to the ZX81 the module causes the micro to bleep every time a key is successfully depressed, thus making keying in possible without constant reference to the screen.

The Bleep is completely self-contained and is suffi-

ciently small that it actually fits inside the ZX81 casing. It is easily installed, and no soldering is required.

The unit functions equally well in both the FAST and SLOW modes.

The ZX81 Bleep, together with fitting instructions, is available, within one week, from Fulcrum Products, Hillside, Steep Lane, Findon, West Sussex, price £8.95 (including VAT and postage and packing).



ZX80/I PRICE WAR!

ZX KEYBOARD FULLY CASED WITH REPEAT KEY



£37.95
incV.A.T.

Fully cased keyboard £37.95
Uncased keyboard £27.95
Keyboard case £10.95

This is a highly professional keyboard using executive buttons as found on top Quality Computers. It has a Repeat key and comes complete in its own luxury case. This is a genuine professional keyboard and should not be confused with toy keyboards currently available on the market.

16K RAMPACK

MASSIVE ADD ON MEMORY

ORDER WITH
YOUR CREDIT
CARD

£32.95
incV.A.T.

WHY WAIT TO PAY MORE

FAST IMMEDIATE DELIVERY

Post To
Dept CW3
**KAYDE ELECTRONIC
SYSTEMS**
48/49 Exmouth Road
Great Yarmouth
Norfolk NR30 3DP
Tel 0493 57867

All products include VAT are fully built and tested and come with a complete Money Back Guarantee

PLEASE SEND ME.....	RAM PACK/S	£32.95 each
PLEASE SEND ME.....	CASED KEYBOARD/S	£37.95 each
PLEASE SEND ME.....	UNCASED KEYBOARD/S	£27.95 each
PLEASE SEND ME.....	KEYBOARD CASE/S	£10.95 each

I enclose £.....

NAME

ADDRESS

.....

.....

.....

Please add £1.50 P&P and make cheques payable to

Kayde Electronic Systems.

Club Reports

A lesson for the rest of the country?

David Kelly talks to Mike St John about his innovative school computer education club

A strange ritual begins at Longfield School each Friday lunchtime. From 12 noon a small queue begins to form, grows, and by half past the hour stretches away out of sight. The computer club is about to convene.

Longfield is a comprehensive with 1390 pupils and Mike St John is the head of its Computer Department, one of the most advanced in Europe. Mike introduced me to Neil Hancock, the systems manager, a 15-year-old who is preparing for his O-levels next year. He explained how the system came into being and how it is operated.

In 1976 pupils at the school formed a computer club and, with help from the Parents' Association, the school purchased an Altair 8800 micro computer in the following year.

This computer had been carefully selected to meet the requirements of both the club and the CSE, O- and A-level computer studies curricula.

The Altair was bought in kit-form and members of the club put it together. Since then the computer studies department has never looked back.

When the system was inaugurated on October 27, 1977 there were less than 30 members of the club. Now there are nearly 200 pupils using the system.

This expansion was always planned and Neil explained that it was precisely for that reason that Mike chose the Altair. A multi-user machine was essential and

Longfield now has 16 terminals in full-time operation.

The organisation of the department is unusual since it is run, as far as possible, as a commercial installation.

At the start of each term the computer department officers are elected. Neil pointed out some of the other pupils busy at the terminals, among them the software controller, chief software writer, supplies officer and engineers.

In common with many of the students, Neil is writing programs intended for business use in his spare time. At the moment he is developing a data handling package for a building company to enable them to produce work quotations quickly and easily.

I asked Neil what he hoped to do when he left Longfield. He frowned and said, 'I don't really know — something in computers.'

When the lesson in progress ended Mike St John was free to talk and he explained how he came to be in charge of the oldest established secondary school computer department.

When Mike first went to Longfield, from a job as a financial analyst, computer studies departments were unheard of. For a while the school had access to the main-frame computer at Mid-Kent College of Technology. But the only communication with the machine was by post.

'It was a bit like trying to learn to drive using pictures!' said Mike.

A computer in the school was essential but, with an initial budget for the department of only £50, donations from the Parents' Association and local businesses were much needed.

Now, using these gifts and money raised from sales of software produced by the pupils themselves, he has built up an enviable system. In five years the school has the most advanced micro system of any secondary school in Europe and Mike reckons they are the only school in the region to have a hard disk storage facility.

Mike firmly believes in an 'open house' policy. The computer room opens at 8.30 in the morning and closes at 9.30 in the evening. During that time there is rarely a free terminal and, as far as possible, he leaves the running of the system to the pupils.

Continuing his motoring metaphor, Mike explained why the young scholars have to be dragged from their terminals in the late evening:

'It's because the kids are driving,' he says, 'that's why the subject has taken off. Solving their own problems — they get a kick out of that.'

Mike is critical of the way computer studies are usually conducted in schools. As regional organiser of MUSE (Micro



Eyes down ... full house at Longfield

Users in Secondary Education) he is in a position to appreciate the general ignorance of computers in secondary education.

This ignorance, he feels, is shown by the mad scramble of some schools to offer computer education. And this, coupled with a fundamental lack of understanding, has produced generally lamentable examination results.

Over 5600 pupils took the AEB (Alder-shot) O-level last year and the overall pass rate was 18 per cent.

Mike St John is justifiably proud that Longfield's results last year showed a 97 per cent pass rate.

As he comments, 'Nobody goes into unemployment from Computer Studies at Longfield.'

When I asked Mike if he minded if I took his photograph for this article he declined.

'It's not me you want to photograph — it's the kids.'

Mike indicated the classroom and terminals: 'This is theirs — not mine.'

For your diary

Edinburgh ZX Computer Club meets at 7.30 pm on the second Wednesday of every month at the Claremont Hotel, Claremont Crescent, Edinburgh.

Occasional Saturday workshops and talks are held and there is a club newsletter and Software library.

Annual membership is £5 (£3 for students, children OAPs and the unwaged).

More information from Keith Mitchell, 19 Meadowplace Road, Edinburgh (031 334 8483).

Edinburgh ZX Club is also holding the first ZX fair in Scotland on July 24. The show, featuring over 30 exhibitors, is at Meadowbank Stadium and will be open from 10 am to 6 pm.

Further details from Gordon Hewitt, 3 Baberton Mains View, Edinburgh (031 332 1163).

We want to hear from you!

Whether you are starting a new club, holding a special meeting, or just changing the venue, we want to hear from you.

Write to David Kelly, Club News, Popular Computing Weekly, Hobhouse Court, 19 Whitcomb Street, London WC2 7HF or call him on 01-930 3271.

Paintbox

Brian Reffin Smith explores the world of computer art

Nobody would ever deny that the quality and style of superior television graphics will always place the micro version into the realms of inferiority. But there's no need to have a complex about it.

To get those high quality graphics with crystal image and high-speed processing, you need to spend a fortune — tens of thousands of pounds! And if you could afford that you wouldn't be here, hoping to find ways of improving the graphics capabilities of your micro.

The fact is, all that high technology with its sky-high price tag is quite unnecessary. Computing quickly teaches that its not how you display it on the screen that's important but exactly what it is that you're displaying.

In other words, the message is the medium and *not*, as in the arty jargon of yesteryear, the converse. So all you have to do is adopt the same approach that a trendy illustrator uses when he's preparing a rough.

Then, in order to get his 'message' through, any quickly etched out sketch will do.

When you're using graphics on small systems, it's as well to remember this, the most direct, approach. Indeed, you can make a virtue out of this necessity to get the message through and go on to produce the basis of non-trivial graphics software package.

I have made two such systems, both available shortly. One is called *Jackson*, and runs on that ubiquitous educational and research computer, the 3802 from Research Machines.

Then there are two smaller programs, related to each other, soon to be produced by BBC Publications for the BBC micro.

One is concerned with *Drawing*, the other with *Painting*. These are only approximations to the sort of images that can be produced. They run on the

Model A or B machine — so you can see how small and tight they have to be — running in the small amount of memory available in the Model A when graphics are used.

Later there is to be a third, large, general-purpose graphics package to run just on the Model B.

The *Jackson*, running on different principles to the BBC programs, is a visualisation aid. It is being used by a wide range of artists and designers at the Royal College of Art. I wanted it to be of use to, say, a textile designer (with its repeat patterns facility), someone wanting slides to illustrate a talk (information graphics in general), a painter, industrial designer, filmmaker and so on.

Because of the possible combinations of memory, disc size and input device (advanced joystick or digitizing pad) there are several versions of *Jackson*, but it is hoped that the Government-funded MEP body will make them generally available in the education area.

The BBC programs are driven directly from the keyboard, using the function and cursor control keys.

Even though, on a micro, colours and numbers of pixels (plottable points) are limited (there's no such thing as a true high-resolution micro) you can still 'say' a lot on a tv screen with a small computer — enough not to run out of ideas anyway.

As an experiment, I once got a group of art students to use a very simple program on an old Video

Genie, drawing with Ascii characters on the screen.

The letters could only appear in 'normal' print positions, unlike the BBC machine where they can be plotted with the same accuracy as graphics, yet even in this constrained, coarse environment, stylistic differences and expressions came through quite strongly.

Although a million pixels and thousands of colours are ideal, the use of low-cost colour graphics systems has hardly been fully explored. And we are still limited far more by our imaginations than by the technology!

Finally, here is a short program based on some of the ideas used in the BBC programs, which sketches a pot-plant.

Whilst I would normally avoid such subject matter, I wanted to explore the possibilities of more tentative, less 'definite' graphics with the BBC machine, in this clichéd area. Try it and see if you think it's a step in that direction.





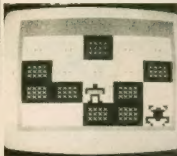
```
100 REM FLOWERS B.R.SMITH 1982
110 REM FOR BBC MICRO A OR B
120 REM SET BREAK KEY TO MODE 7 & LIST
130 *KEY10 "MODE7|HOLD|I"
140 REM CHECK MODEL A OR B
150 IF HIMEM>84000 THEN MODE1 ELSE MODE5
160 COL=1
170 REMIX COLOURS USING VDU19
180 FORI=1703:VDU19,I,RND(3),0,0,0:NEX
```

TI

```
190 CLG
200 GCOL0,3
210 REM DRAW POT
220 FOR I=1 TO 300 STEP12:MOVE550-I/3,
I:DRAW710+I/3,I:NEXTI
230 REMARKABLY RANDOMISED 'POLYGON ROUTINE
240 REM SET TIMER
250 NOW=TIME
260 REPEAT
270 HS=RND(500)+200:VS=RND(500)+400
280 C=RND(2)-1
290 A=RND(140)+50:8=RND(100)+50
300 N=70
310 ANGLE=2*PI/N
320 C=COS(ANGLE+.02):S=SIN(ANGLE)
330 XA=1:YA=1
340 FORI=1 TO N*3
350 VS=VS+RND(40)-20:HS=HS+RND(40)-20
360 COL=COL+.1:IF COL>4 THEN COL=1
370 GCOLG,COL
380 X=XA+C-YA*S
390 Y=YA+S+YA*C
400 XA=X:YA=Y
410 IF XA=0 THEN510
420 REM I.E. DRAW OR MOVE
430 IF I>1 THEN P=5 ELSE P=4
440 PLOT P,A*XA+HS,B*YA+VS
450 REM GRAPHICS WINDOW AROUND FLOWER
460 VDU24,A*XA+HS;B*YA+VS:HS+200;VS+100;
470 IF I=1 THEN 500
480 REM PLOT 86=INVERSE COLOUR TRIANGLE
490 PLOT86,HS,VS
500 DRAWA*XA+HS,B*YA+VS
510 NEXTI
520 REMOVE GRAPHICS WINDOW
530 VDU26
540 REMEMBER THE PLANT STEMS...
550 MOVEHS,VS
560 DRAW530+RND(100),300
570 REM DISGUISED GOTO!
580 UNTIL TIME > NOW+24000
590 PRINT"DONE"
```

Reviews

software



Mazogs

Bug-byte, 100 The Albany, Old Hall Street, Liverpool 3.
16K ZX81
Price £10

Mazogs is a superb new concept in ZX81 games, and is so good that even when it's a tired old concept you will still want to play now and then.

I don't know how long it would take to become a tired old concept, but I'm sure you can look forward to weeks of pleasure before letting anyone else in the family have a go.

Yes, as you can guess from the title, this is a maze. With a few plusses. Like you can get to see a fair-sized chunk of the maze only after one of the mazogs have overcome you.

Oh, I didn't mention the mazogs. Well, they're very active seekers of treasure-hunters, a bit like black elves. Nasty!

You have a 50:50 chance of beating one bare-handed. A sword helps. There are a few swords in the maze walls. You can pick one up if you're not carrying the treasure.

If you're carrying the treasure, it's a hard decision. Still, that big bar of silver may be worth less than your life. I guess.

There are blinking prisoners in the maze walls, too. It's their eyes that blink really. The prisoners can guide you a little way along the route to the treasure, or, when with it, back to safety. Nice prisoners, aren't they?

Anyway, it is possible to find the treasure (though it is always at least a hundred moves from start. Can be 400 it says here. Wow). And it is possible to get back safely with it.

But it's a big maze, and you can see very little of it in the normal view, and little more in the bird's-eye view, and, like I said, not all of it in the post-mortem.

Next game, of course, it's a different maze anyway.

Bug-byte provide a close-printed (and

not well written) four-page leaflet to help you get into this grossly addictive game. How can I describe it in the space that's left?

Summary
Great.

KJ

Six Programs

PR Software, 28 The Fairway, South Ruislip, Middlesex.
Vic20, unexpanded
Price £7.50 inc. p&p.

As the title of this cassette states somewhat explicitly this is a cassette with six programs on it. They are *War*, *Smashout*, *Blackjack*, *Logic*, *Pickupgame* and *Alarm Clock*. All the programs are for an unexpanded Vic20 and are written in Basic.

The games all loaded and ran without problems.

There are not instructions for *War*, but the game is so slow moving that one had plenty of time to guess what was happening. Red tanks are lined up along the top of the green screen and one has the occasional chance to shoot at the tanks from nine entrenched positions at the bottom of the screen.

You have to wait too long before the fire button becomes active and then too long again before anything happens. Such is the penalty of using Basic for games which are supposed to be real-time, or active.

The red on green was an unfortunate choice of colours. By the time the tanks had moved down the screen, line by line and seemingly ever more slowly we began to wish that some more thought had gone into this game.

Smashout suffers from the same problem. It is the same as *Breakout* except that the programmers have compensated for the slowness of Basic by making the bat three or four times the usual size.

Blackjack is quite straightforward except that there are no instructions. We had to play all the keys to discover that the E key let you stick and the H key would turn another card.

Logic is mastermind with the usual combination of five colours in a hidden sequence.

Pickupgame gives you a pile of stones and you and the computer take it in turns to pick-up a number of stones, each trying to avoid being left with the losing last stone.

The final program, *Alarm Clock*, is an odd choice for a games cassette. You enter the time, set the time for the alarm, and in due course the alarm goes off — a sort of flood warning type siren. Special features include ever-changing back-

ground colours and clock strikes every hour.

Summary

This is a poor collection of programs, reminiscent of the cassette being released onto the market two years ago. First time users might find the cassette useful, if only to give them an idea of how much the standard of software has since improved.

The Fast One

Campbell Systems, 15 Rous Road, Buckhurst Hill, Essex.
Price £15.

I'd love to say that the best thing about this program is its title — but I can't. If title is a delight, the program is better.

The title is not meant to make you think of gaming, but of business. This supplier has already a well-deserved reputation for data-processing software, the essence of business computing. *The Fast One* must enhance that reputation since it is an exceedingly versatile program and, wow, it is fast.

The speed comes from the fact that this is a great big string-handling routine. Well, it's the string that's big — all the data in all your records go into it. With your commands dealt with almost entirely in machine code, and up to 50K of immediate access storage (if you use a 64K RAM), this becomes an exceedingly powerful tool.

For your £15 (a very fair price) you get a cassette with the main program and a demonstration version, plus a jam-packed but fairly well-written 12-page handbook. Practise is needed to understand such a system, and Campbell reckons that'll take you an hour. Well, I think they do themselves less than justice there — TFO is extremely easy to use.

It is, of course, menu-driven. There are 11 main options — with everything you can think of except one — start again. Each option routine usually has a good number of sub-options on continuous display.

Thus you can define and re-define classification headings, fields and records, obtain screen display or printout of data in a range of forms, and dig up data to your heart's content.

There are, I know, a rapidly-increasing number of business users of the ZX81. This is almost certainly the best data-processing package yet available, particularly in regard to its speed. Sample it if you have data to process — and who hasn't?

Summary

A most impressive program, well documented and satisfyingly versatile. KJ

Reviews

hardware

Keyboard Audio Tone

TV Services of Cambridge Ltd.,
Chesterton Mill, Fenches Road,
Cambridge CB4 3NP. Tel. 0223-358366.
Price £8.95 assembled, £11.85
factory-fitted.

The main claim to fame for this firm has been that they do all of Sinclair's repair work on ZX80s and ZX81s etc.

They have now decided to put all their experience into producing a product of their own — a printed circuit board with all components soldered into place and only five wires need to be soldered to the printed circuit board of the ZX81 to make it work.

If this part worries you, just send your ZX81 to them (without the power pack and leads) for them to fit it for you.

The board is attached to a miniature loudspeaker and both of these are stuck to the inside of the ZX81's case underneath the keyboard.

If you have something there already such as a character board or extra memory, there is no problem. The KAT board is so thin that it will even fit underneath the ZX81's printed circuit board without obstructing the edge connector or touching any other components.

The KAT gives two tones to reassure the user, one when the key is pressed and another when the key is released. This will work on all keys and in all modes including FAST and SLOW.

The tone produced is quite loud, but it required the level of the tone can be increased. This is not the only use of this little unit, however, it can be programmed to give a beep during a program to simulate an explosion or stimulate an input from the user.

On INPUT or typing in programs the unit works as normal, but if you are using INKEYS then a PAUSE of at least five must be used before the INKEYS to produce the tone.

The KAT will even help you with SAVING and LOADING as it will beep at the beginning and end of a program, reminding the user that he needs to turn off the tape recorder. This is very useful, especially on long 16K programs as the beep is quite loud enough to be heard several feet away while you are making a cup of tea or something.

If you are fitting this device yourself it might be as well to fit a switch in the red (+5 volt) lead so that it can be switched off if not required.

The board is easy enough to fit if you can solder, though I wish that the wires were labelled to say what pins they went to (although it is clear what colours they are it

is not clear whether they are connected to power, etc).

The soldering requires a little care as the connections must be very short or they will connect to adjacent pins. There is also a strap on the board marked B and C to adjust the level of the tone but I would think that the lowest level C was quite loud enough.

Summary

A very useful gadget which makes keyboard entry even on a Sinclair flat keyboard very easy. This firm have obviously put a great deal of thought into what the user requires and the two-tone system makes sure the user gets it right every time.

Another advantage is that they will fit it for you. Most ZX81 users do not like delving into the inside of their machines for fear of damaging some vital component. A very useful device which this reviewer will keep on his machine for a long time. **SA**



Personal Computer Book

By Robin Bradbeer
Price £5.95.

With a change of publisher and a great deal of up-dating this remarkably successful book has now appeared in a second edition, after no more than a couple of years. Of course, that has been a rather active couple of years so the new edition is entirely welcome.

The book comes in three parts, all useful and carefully written. Armed principally at the person hesitating about dipping his or her toe into the computing torrent, those three parts are not consistent in value. Firstly we have several chapters on what a computer is, what it does, and how it does it. This is associated with an appendix on binary arithmetic.

Now Robin Bradbeer is a lovely chap and one of Britain's experts on home computing. He is, however, a high-level lecturer and must come to realise that home computer users, and especially people thinking of joining the club, are not going to need much of this knowledge. Indeed they will be put off if they find it in the opening chapters of a book.

Robin, why not relegate all the technical stuff to a small appendix in the third part, if you can't bear to omit it entirely!

The other two parts are exceedingly useful though, and will remain so long after the novice has become an expert.

The first is a comprehensive description of the micros on the British home market — well 58 of them, ranging from Microtan through ZX81, BBC and 4802 to the Ithaca DPSi (at £4,000).

In each case there is a photograph and a few paragraphs of good description, with details of software availability peripherals and prices (and 1981).

Criteria for choice and the chapters associated with this section.

The other part is a wealth of useful appendices, making an invaluable reference bank for everyone. Here are brief but very adequate details of such things as interface standards, hardware suppliers, clubs and user groups, magazines and books.

Summary

Apart from the unnecessarily technical early material, this is a most valuable book for all — pre-beginners and experts. **ZZ**

ZX81 Basic Book

By Robin Norman
Price £5

One of the saddest Sinclair-associated stories of 1981 was the publication of Robin Norman's *Learning Basic* with your Sinclair ZX80 within a week or so of the launch of the ZX81. Well, Newnes have done it again. Robin Norman's ZX81 book preceded the Spectrum launch by less than a month.

Is there a moral there? Expect a new Sinclair micro when you see Newnes' book on the current one? Surely not that, but if there is a moral, it concerns publishing speeds and the speed of computer development. And it explains why grotty, poorly presented but rapidly provided books do so well.

For Robin Norman's works are indubitably not grotty or poorly presented. And as far as established publishers are concerned, they have both reached the bookshops in record time. Newnes are learning fast, I guess, and like everyone else they're working flat out on a book on the Spectrum, though this time not with Robin Norman at the helm.

Maybe that's a pity. Norman's new book is every bit as excellent for the newcomer as the previous one. He retains his delightfully readable but authoritative style, and is most thorough in developing his reader's understanding on Sinclair Basic. **KJ**

Our classifieds are faster.

Do you want to sell your computer and buy a bigger and better one?

Have you ever thought of trying to make some money out of selling tapes of your own programs?

Whatever it is you want to buy or sell why not use our classified pages?

It has to be better than waiting for up to nine weeks to get into one of the old monthly magazines.

Not only that, but our rates are very reasonable.

For private individuals it only costs 20p per word, with a minimum of 10 words.

We can make it so cheap because we charge companies using the classified columns 40p per word.

The classified pages can be used for semi-display advertising.

The cost for this is £10 per single column centimetre, with a minimum charge of £30.

All copy for the classified pages must be pre-paid. (You'll find a handy form on page 22).

Cheques and postal orders should be made out to *Popular Computing Weekly*. Your advertisement should arrive at least two weeks before the publication date.

If you have any queries regarding Classified or semi-display advertising please call Alastair Macintosh on 01-930 3840

Popular Computing Weekly.
The fast one.

Open Forum

Open Forum is for you to publish your programs and ideas.

It is important that your programs are bug free before you send them in. We cannot test all of them.

Contributions should be sent to: Popular Computing Weekly, Hobhouse Court,
19 Whitcomb Street, London WC2H 7HF.

How to contribute

Each week the editor goes through all the programs that you send to Open Forum in order to find the Program of the Week.

The author of that program will qualify for DOUBLE the usual fee we pay for published programs.

(The usual fee is £10.)

Then at the end of the month the four best programs of the week go forward to our amazing Program of the Month contest, for which there is a STAR prize.

This month the star prize is a super ZX printer, worth £59.95!

At the end of the year, all the best Programs of the Month will be entered in the super colossal competition, Program of the Year.

So send in your program today!

Presentation hints

Programs which are most likely to be considered for the Star Prize will be computer printed and accompanied by a cassette.

The program will be well documented, the documentation being typed with a double spacing between each line.

The documentation should start with a general description of the program and then give some detail of how the program has been constructed and of its special features.

Listings taken from a ZX Printer should be cut into convenient lengths and stuck down on to white paper.

Please enclose a stamped, self-addressed envelope.

Never a crossword

on ZX81

This program allows the user to do cross-words while at the same time, having the ability to correct any mistakes.

First the size of the crossword is input then each row is entered with a string of 0s and 1s with a 0 representing a space and a 1 is a block.

After the grid is completed each word is entered in the following way:

first the row letter

Never a crossword

By David Poole

```

10 REM "NEVER A CROSSWORD"
20 REM BY "DAVID POOLE" APRIL 1988
30 REM "THIS PROGRAM ALLOWS THE USER TO ENTER A CROSSWORD WITHOUT THE CHANCE OF MAKING A MISTAKE."
40 REM "FIRST ENTER THE SIZE OF THE CROSSWORD. NE-
50 REM "XT INPUT EACH ROW WHEN REQUESTED."
60 REM "AFTER SETTING UP THE WORD IS ENTERED THUS:
70 REM "1ST THE ROW LETTER"
80 REM "AND THE COLUMN LETTER"
90 REM "3RD "-"*ACROSS OR
100 REM "D" DOWN"
110 REM "ALL ENTERED IN ONE S
120 REM "EG - ABDSINCLAIR"
130 REM "TO STOP PROGRAM TYPE
140 REM "STOP"
150 REM "TO COPY TO PRINTER T
160 REM "Y"
170 REM "PRESS N/L TO CONTINU
180 REM "E"
190 REM "INPUT A8
200 REM "FOR 1-30 TO 37+U
210 REM "PRINT 1-37+U
220 REM "PRINT 1-37+U
230 REM "PRINT 1-37+U
240 REM "PRINT 1-37+U
250 REM "PRINT 1-37+U
260 REM "PRINT 1-37+U
270 REM "PRINT 1-37+U
280 REM "PRINT 1-37+U
290 REM "PRINT 1-37+U
300 REM "PRINT 1-37+U
310 REM "PRINT 1-37+U
320 REM "PRINT 1-37+U
330 REM "PRINT 1-37+U
340 REM "PRINT 1-37+U
350 REM "PRINT 1-37+U
360 REM "PRINT 1-37+U
370 REM "PRINT 1-37+U
380 REM "PRINT 1-37+U
390 REM "PRINT 1-37+U
400 REM "PRINT 1-37+U
410 REM "PRINT 1-37+U
420 REM "PRINT 1-37+U
430 REM "PRINT 1-37+U
440 REM "PRINT 1-37+U
450 REM "PRINT 1-37+U
460 REM "PRINT 1-37+U
470 REM "PRINT 1-37+U
480 REM "PRINT 1-37+U
490 REM "PRINT 1-37+U
500 REM "PRINT 1-37+U
510 REM "PRINT 1-37+U
520 REM "PRINT 1-37+U
530 REM "PRINT 1-37+U
540 REM "PRINT 1-37+U
550 REM "PRINT 1-37+U
560 REM "PRINT 1-37+U
570 REM "PRINT 1-37+U
580 REM "PRINT 1-37+U
590 REM "PRINT 1-37+U
600 REM "PRINT 1-37+U
610 REM "PRINT 1-37+U
620 REM "PRINT 1-37+U
630 REM "PRINT 1-37+U
640 REM "PRINT 1-37+U
650 REM "PRINT 1-37+U
660 REM "PRINT 1-37+U
670 REM "PRINT 1-37+U
680 REM "PRINT 1-37+U
690 REM "PRINT 1-37+U
700 REM "PRINT 1-37+U
710 REM "PRINT 1-37+U
720 REM "PRINT 1-37+U
730 REM "PRINT 1-37+U
740 REM "PRINT 1-37+U
750 REM "PRINT 1-37+U
760 REM "PRINT 1-37+U
770 REM "PRINT 1-37+U
780 REM "PRINT 1-37+U
790 REM "PRINT 1-37+U
800 REM "PRINT 1-37+U
810 REM "PRINT 1-37+U
820 REM "PRINT 1-37+U
830 REM "PRINT 1-37+U
840 REM "PRINT 1-37+U
850 REM "PRINT 1-37+U
860 REM "PRINT 1-37+U
870 REM "PRINT 1-37+U
880 REM "PRINT 1-37+U
890 REM "PRINT 1-37+U
900 REM "PRINT 1-37+U
910 REM "PRINT 1-37+U
920 REM "PRINT 1-37+U
930 REM "PRINT 1-37+U
940 REM "PRINT 1-37+U
950 REM "PRINT 1-37+U
960 REM "PRINT 1-37+U
970 REM "PRINT 1-37+U
980 REM "PRINT 1-37+U
990 REM "PRINT 1-37+U
1000 REM "PRINT 1-37+U

```

second the column letter third "A" or "D" for across or down fourth the word.

all the above are entered in one statement, eg ABDSINCLAIR displays the word Sinclair starting at row A and column B with the word going downwards.

The program can be stopped or the display copied at any time, with additions to the program it will be impossible to SAVE an uncompleted crossword on tape (perhaps using an array).

Volumes

on ZX81

Volumes will run in an unexpanded ZX81. It will calculate the volume of a shape given the correct data.

When run a list of possible shapes will appear with the data they require underneath. The data is in order of entry.

'W'=width

'L'=length

'H'=height

'R'=radius

You must first enter the first letter of the shape and then the data, eg, for a cone enter "C" then radius, then height.

```

10 PRINT "...BLOCK-CONE-PYRAMID-TUBE-
20 SHERE"
30 REM "WLM---RH---FH---R"
40 INPUT IS
50 CLS
60 IF IS="S" OR IS="P" THEN INPUT A
70 INPUT IS
80 IF IS<>"S" THEN INPUT B
90 IF IS="B" THEN PRINT "BLOCK="AxBxC
100 IF IS="C" THEN PRINT "CONE="
110 IF IS="P" THEN PRINT "PYRAMID="
120 IF IS="T" THEN PRINT "TUBE="
130 RUN

```

Mastermind

on BBC Micro

This program, for a Model A or Model B BBC Micro, plays a version of Mastermind, in which the computer selects a random 4-digit number, and you have to find it using your skill and judgement.

The computer gives you clues as to how close you are to finding the number by

Open Forum

Mastermind

By Mark Rogers

```

10 REM *****
20 REM 40 Mastermind BBC style 40
30 REM 40 By Mark Rogers 12/80/80
40 REM 40 C.P.M.D. 1980 40
50 REM *****
60 REM 40 (C) 1980/80
70 REM 40 (C) 1980/80
80 REM 40 (C) 1980/80
90 REM 40 (C) 1980/80
100 REM 40 (C) 1980/80
110 REM 40 (C) 1980/80
120 REM 40 (C) 1980/80
130 REM 40 (C) 1980/80
140 REM 40 (C) 1980/80
150 REM 40 (C) 1980/80
160 REM 40 (C) 1980/80
170 REM 40 (C) 1980/80
180 REM 40 (C) 1980/80
190 REM 40 (C) 1980/80
200 REM 40 (C) 1980/80
210 REM 40 (C) 1980/80
220 REM 40 (C) 1980/80
230 REM 40 (C) 1980/80
240 REM 40 (C) 1980/80
250 REM 40 (C) 1980/80
260 REM 40 (C) 1980/80
270 REM 40 (C) 1980/80
280 REM 40 (C) 1980/80
290 REM 40 (C) 1980/80
300 REM 40 (C) 1980/80
310 REM 40 (C) 1980/80
320 REM 40 (C) 1980/80
330 REM 40 (C) 1980/80
340 REM 40 (C) 1980/80
350 REM 40 (C) 1980/80
360 REM 40 (C) 1980/80
370 REM 40 (C) 1980/80
380 REM 40 (C) 1980/80
390 REM 40 (C) 1980/80
400 REM 40 (C) 1980/80
410 REM 40 (C) 1980/80
420 REM 40 (C) 1980/80
430 REM 40 (C) 1980/80
440 REM 40 (C) 1980/80
450 REM 40 (C) 1980/80
460 REM 40 (C) 1980/80
470 REM 40 (C) 1980/80
480 REM 40 (C) 1980/80
490 REM 40 (C) 1980/80
500 REM 40 (C) 1980/80
510 REM 40 (C) 1980/80
520 REM 40 (C) 1980/80
530 REM 40 (C) 1980/80
540 REM 40 (C) 1980/80
550 REM 40 (C) 1980/80
560 REM 40 (C) 1980/80
570 REM 40 (C) 1980/80
580 REM 40 (C) 1980/80
590 REM 40 (C) 1980/80
600 REM 40 (C) 1980/80
610 REM 40 (C) 1980/80
620 REM 40 (C) 1980/80
630 REM 40 (C) 1980/80
640 REM 40 (C) 1980/80
650 REM 40 (C) 1980/80
660 REM 40 (C) 1980/80
670 REM 40 (C) 1980/80
680 REM 40 (C) 1980/80
690 REM 40 (C) 1980/80
700 REM 40 (C) 1980/80
710 REM 40 (C) 1980/80
720 REM 40 (C) 1980/80
730 REM 40 (C) 1980/80
740 REM 40 (C) 1980/80
750 REM 40 (C) 1980/80
760 REM 40 (C) 1980/80
770 REM 40 (C) 1980/80
780 REM 40 (C) 1980/80
790 REM 40 (C) 1980/80
800 REM 40 (C) 1980/80
810 REM 40 (C) 1980/80
820 REM 40 (C) 1980/80
830 REM 40 (C) 1980/80
840 REM 40 (C) 1980/80
850 REM 40 (C) 1980/80
860 REM 40 (C) 1980/80
870 REM 40 (C) 1980/80
880 REM 40 (C) 1980/80
890 REM 40 (C) 1980/80
900 REM 40 (C) 1980/80
910 REM 40 (C) 1980/80
920 REM 40 (C) 1980/80
930 REM 40 (C) 1980/80
940 REM 40 (C) 1980/80
950 REM 40 (C) 1980/80
960 REM 40 (C) 1980/80
970 REM 40 (C) 1980/80
980 REM 40 (C) 1980/80
990 REM 40 (C) 1980/80

```

telling you if you have any bulls or cows. A bull is a correct number in the correct place, and a cow is a correct number in the wrong place.

Thus, if the computer chose '3672' as its number, and you inputted '3826', the computer would say: '1 bull and 3 cows'.

The number chosen by the computer consists of four *different* digits, so that it would not choose for example '3646'. Any illegal entry inputted by the user is rejected by the computer.

Many of the programming techniques used in this program I discovered while working through the BBC's 'Welcome' Tapes.

The program runs in the Teletext mode, Mode 7, and colours are used throughout. As with many of the programs on the Welcome tape, the main 'core' of the program is at the beginning, with all the procedure definitions at the end (line 240 onwards).

The computer starts by changing mode, beeping, and turning the cursor off (lines 80 and 90). It then prints the title and the description of bulls and cows (PROCSetup) and chooses its random number (PROCNumber).

It then starts the clock, and goes into a REPEAT UNTIL loop of getting the user's guess, and calculating the number of bulls and cows (PROCgetguess and PROCcalculate).

It repeats this until the user has found the number (when bull=4), and then displays a suitable message, relative to the number of guesses taken (PROCResult).

The user is then asked if he wants to go again (PROCagain), and the game accordingly either ends or starts again.

Music 2

on ZX81

In the second issue I read Peek & poke and saw the article on forming music on the ZX81. I typed this into my 1K ZX81 and found it very surprising. I have made a similar but improved program, called Music 2.

Target practice

on BBC Micro

In each run you have 10 attempts to hit the target with a shot from a gun the other side of a barrier. The routine in lines 220-250 plots the parabolic trajectory (you can add lines to bring in air friction and wind if you wish).

For each run, gun and target are placed at random and the barrier has random height and width.

The program employs the BBC feature of:

Open Forum

Music 2

By Lee Hayden

```
10 COSUB 100 X (INT (RND x 9)) + 1
20 RUN
100 FOR N=1 TO RND x 100
110 SLOW
120 FAST
130 NEXT N
140 RETURN
200 FOR N=1 TO RND x 100
210 SLOW
220 FAST
230 NEXT N
240 RETURN
300 FOR N=1 TO RND x 100
310 SLOW
320 FAST
330 NEXT N
340 RETURN
400 FOR N=1 TO RND x 100
410 SLOW
420 FAST
430 NEXT N
440 RETURN
500 FOR N=1 TO RND x 100
510 SLOW
520 FAST
530 NEXT N
540 RETURN
600 FOR N=1 TO RND x 100
610 SLOW
620 FAST
630 NEXT N
640 RETURN
700 FOR N=1 TO RND x 100
710 SLOW
720 FAST
730 NEXT N
740 RETURN
800 FOR N=1 TO RND x 100
810 SLOW
820 FAST
830 NEXT N
840 RETURN
900 FOR N=1 TO RND x 100
910 SLOW
920 FAST
930 NEXT N
940 RETURN
```

P.S. don't forget to turn the volume up!

Target practice

By Eric Deeson

```
10 VDU 23, 225, 3, 6, 60, 40, 104, 60, 126, 225 (define characters)
20 VDU 23, 226, 36, 90, 156, 90, 60, 155, 24, 60
30 VDU 23, 227, 24, 36, 66, 153, 153, 66, 36, 127
40 VDU 23, 228, 28, 42, 85, 170, 127, 170, 85, 225
50 MODE 5 (set up playing area)
60 GCOL 0, 130
70 GCOL 0, 0
80 VDU 5
90 CLG
100 A = RND(4) + 1 (set up random sites)
110 B = RND(4) + 15
120 C = RND(9) + 1
130 D = 0
140 REPEAT (go round)
150 D = D + 1 (go loop)
160 PROC G(A,B,C) (set up characters)
170 MOVE 10, 270: INPUT "Angle", A
180 MOVE 10, 230: INPUT "Speed", S
190 AN = AL*PI/180 (convert to radians)
200 X = 0 (trajectory loop)
210 REPEAT
220 X1 = X + 64 * (A + 1)
230 Y = B + X * TAN(AN) - X1/CE * * COS(AN)/2
240 PLOT 69, X1, Y + 32
250 X = X + 16
260 UNTIL X>1280 OR Y< 32 OR POINT (X1 + 9, Y + 32) = 8 (end trajectory check)
270 PRINT CHR$(226) (detonate)
280 FOR F = 1 TO 10: NEXT (delay)
290 CLG
300 UNTIL D = 10 OR ABS (X1 + 9 * 64)<40 (end go round)
310 IF D = 10 THEN PRINT TAB (4,10): "USELESS"
ELSE PRINT TAB (5,10): "GOOD SHOT"
"you got it in "
320 FOR F = 1 TO 10: NEXT
330 PRINT "HAVE ANOTHER GO....": GOTO 90
340 DEF PROC (A,B,C) (restart)
350 LOCAL B
360 PRINT TAB (A, 30): CHR$(225) (gun)
370 PRINT TAB (B, 30): CHR$(226) (target)
380 FOR D = 1 TO C: PRINT TAB (5,30 - D + 1): (barrier)
STRINGS (C, CHR$(228))*NEXT
390 ENDPROC
```

```
70 REM COLOURAMA
80 BB=INT(254*RND(1))+1
90 POKE 3687BB
100 S=7680: =(128*RND(1))+1
105 P=INT(255*RND(1))+1
110 X=INT(10*RND(1))+1
115 N=INT(44*RND(1))+1
120 FOR I=0 TO 506 STEP N
130 POKE S+30730+X+I,C
140 POKE S+X+I,P
150 NEXT I
180 FOR J=1 TO 50: NEXT J
200 PRINT " "
210 GOTO 80
```

Colourama

By Chris Palmer

- definable characters (10-40);
- mixed text and graphics (80-170 etc);
- random number generation (100-120);
- REPEAT ... UNTIL (the two loops);
- POINT (260);
- procedure rather than sub-routine (160, 340-39);
- STRINGS (380).

Colourama

on Vic-20

The purpose of the animation is to demonstrate varied animation across and down the screen using the poke statement. Random numbers are used deliberately for flexibility but these could be changed in order to repeat a specific action or character required. The program itself or any

such adaptation could also make a useful subroutine.

The variables used are:

BB = Background/Board Colour.

P = character poke number.

X = point where appears.

N = frequency of the character on the screen.

S = Start of screen memory.

C = Character colour.

I = limits of screen area.

J = speed of action.

If you have any comments about Open Forum or about the kind of programs you'd like to see in this section, please write to us.

The address is:
Popular Computing Weekly
Hobhouse Court
19 Whitcomb Street
London WC2

Open Forum

Froggy

By Graham Plowman

[illegible]

Froggy

00 ZX81

The idea of the game is to jump from lily pad to lily pad down the screen and through the gate at the bottom.

But it is not as easy as that, half-way down there is a snail endlessly crossing the screen and the only way to get to the bottom is to jump on his back and then off again where there is a lily pad near.

If you take too long on the snail he will drop you off the edge of the screen.

Also there is a bird who is determined to get you. The only way to escape its clutches is to make jumps from side to side when it gets near.

The game has five lines and gets harder every sheet. On the third and fifth sheet the background colour changes and on the fifth sheet a bonus frog is awarded.

The controls are as follows:

8 right one

5 left one

\$ right three

A left three

L Leap (RND 3, 5, or 7 down)

↓ Jump (2 down)

B Back (2 up)

If you are in a jam there is a hyperspace, key H, along the horizontal line of your frog. And if reaching the gate seems impossible there is a New Sheet button (key N) which draws a new pond.

The only problem with the new sheet button is that your frog goes down a level.

If the game seems too hard the bird can easily be removed or the number of frogs (F) increased.

Correlation

on ZX81

Here is a program to analyse straight line graphs. This 16K program will analyse linear lines to give a correlation coefficient and regression analysis. It is of particular value to people working with graphs that have scattered values that might lie on a straight line, eg statisticians, biologists, students etc.

It is written in simple basic using almost entirely LET and PRINT statements. It does have the advantage of being extremely user friendly.

By entering the X and Y values of a succession of data points, a correlation coefficient can be calculated to show how close to a perfect straight line the data is. A regression analysis will give the properties of that line and if needed a list of X and Y values can be given for the perfect straight line.

There is almost no limit to the number of values that can be entered.

Run it and see!

1 DEN L. CLIPPER
2 DEN COORDINATION COEFFICIENT
AND REGRESSION ANALYSIS OF
THREE RELATED VARIABLES

Correlation

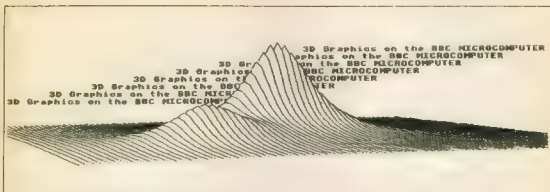
By Lee Frances
Cooper

```

10 PRINT "DO YOU NEED INSTRUCTIONS?"
20 PRINT "ENTER Y FOR YES, N FOR NO"
30 IF INKEY$="Y" THEN GOTO 70
40 IF INKEY$="N" THEN GOTO 40
50 GOTO 50
60 PRINT "THIS PROGRAM WILL CALCULATE THE VALUES OF DATA POINTS IS ENTERED"
70 PRINT "IF YOU ENTERED A"
80 PRINT "ANALYSIS OF THE DATA WILL OCCUR"
90 PRINT "PRESS Y TO CONTINUE"
100 IF INKEY$="Y" THEN GOTO 70
110 GOTO 80
120 CLC
130 PRINT "CORRELATION COEFFICIENT"
140 PRINT "INPUT X AND Y VALUES"
150 PRINT "INPUT X"
160 IF INKEY$="N" THEN GOTO 800
170 PRINT "INPUT Y"
180 IF INKEY$="N" THEN GOTO 800
190 CLC
200 PRINT "ENTER C OR X TO CORRECT VALUES PLEASE"
210 IF INKEY$="C" THEN GOTO 100
220 IF INKEY$="X" THEN GOTO 100
230 LET A=X
240 LET B=Y
250 LET C=X+Y
260 LET D=X-Y
270 LET E=X*Y
280 LET F=X/Y
290 LET G=Y/X
300 GOTO 100
310 PRINT "DO YOU WANT TO STOP?"
320 IF INKEY$="Y" THEN GOTO 800
330 IF INKEY$="N" THEN GOTO 800
340 PRINT "DO YOU WANT TO CONTINUE WITH INPUT (C)?"
350 IF INKEY$="Y" THEN GOTO 800
360 IF INKEY$="N" THEN GOTO 800
370 LET A=B
380 LET B=A
390 LET C=X
400 LET D=X
410 LET E=X
420 LET F=X
430 LET G=X
440 LET H=X
450 LET I=X
460 LET J=X
470 LET K=X
480 LET L=X
490 LET M=X
500 LET N=X
510 LET O=X
520 LET P=X
530 LET Q=X
540 LET R=X
550 LET S=X
560 LET T=X
570 LET U=X
580 LET V=X
590 LET W=X
600 LET X=X
610 LET Y=X
620 LET Z=X
630 LET AA=X
640 LET AB=X
650 LET AC=X
660 LET AD=X
670 LET AE=X
680 LET AF=X
690 LET AG=X
700 LET AH=X
710 LET AI=X
720 LET AJ=X
730 LET AK=X
740 LET AL=X
750 LET AM=X
760 LET AN=X
770 LET AO=X
780 LET AP=X
790 LET AQ=X
800 PRINT "END OF PROGRAM"
810 PRINT "PRESS Y TO CORRECT VALUES"
820 IF INKEY$="Y" THEN GOTO 100
830 IF INKEY$="N" THEN GOTO 100
840 PRINT "END OF PROGRAM"
850 PRINT "PRESS Y TO CORRECT VALUES"
860 IF INKEY$="Y" THEN GOTO 100
870 IF INKEY$="N" THEN GOTO 100
880 PRINT "END OF PROGRAM"
890 PRINT "PRESS Y TO CORRECT VALUES"
900 IF INKEY$="Y" THEN GOTO 100
910 IF INKEY$="N" THEN GOTO 100
920 PRINT "END OF PROGRAM"
930 PRINT "PRESS Y TO CORRECT VALUES"
940 IF INKEY$="Y" THEN GOTO 100
950 IF INKEY$="N" THEN GOTO 100
960 PRINT "END OF PROGRAM"
970 PRINT "PRESS Y TO CORRECT VALUES"
980 IF INKEY$="Y" THEN GOTO 100
990 IF INKEY$="N" THEN GOTO 100
1000 PRINT "END OF PROGRAM"

```

Open Forum



Hi-res graphics

on BBC Micro

The procedure 'gdump' will print the whole screen in mode 11 or mode 4 on to paper using a printer with high res capability. The actual listing is for a Selkosh GP80 but the following notes should allow transfer to other printers.

VDU1 stops the next character from affecting the display.

VDU8 is the code to indicate graphics information on the way.

The graphics information is sent in seven bits. The eighth most significant bit is always set to 1 to indicate that the info is not a control code, hence line 1140. A border is made by lines 1030, 1060, 1170 and 1200.

The main body of the program is built around the FOR X loop (1090 to 1130), where the procedure works its way up then across the screen, transferring the screen data into seven bit codes (the printer works on a seven by five matrix) (line 1110).

The changes to print mode 0 graphics are simply to take into account that the X axis is twice that in mode 4.

Because the mode 0 X resolution is 640, the procedure prints the screen with a 90 degree shift, ie, it prints down the paper instead of across because the printer can only cope with 475 dots across the page.

Since the procedure will probably be the last thing the program will do, there is no need to declare the variables as local.

Calculator

on ZX81

I have recently written this program which converts my ZX81 into a calculator.

All the numerical functions are useable. The user needs to type in the question for the computer.

The program has a self-running routine so type GOTO 9998 instead of SAVE.

Hi-res graphics

By G. L. Jones

```

1000 DEF PROCgdump
1010 REM***MODE4 GRAPHICS DUMP FOR BBC MICRO**
1020 VDU2:VDU1:VDU8
1030 FOR L=0TO257 VDU1:PRINTCHR$(192);:NEXT L
1040 FOR D=0TO1279STEP20
1050 VDU1:VDU10:VDU1
1060 PRINT CHR$(255);
1070 FOR Y=0TO1023STEP4
1080 PSEND=0:INC=1
1090 FOR X=(D+4)TO(D+28)STEP4
1100 PD=POINT(X,Y)
1110 IF PD=1 PSEND=PSEND OR INC
1120 INC=INC*2
1130 NEXT X
1140 PSEND=PSEND OR 128
1150 VDU1:PRINT CHR$(PSEND);
1160 NEXT Y
1170 VDU1:PRINTCHR$(255);
1180 NEXT D
1190 VDU1:VDU10
1200 FORL=0TO257:VDU1:PRINTCHR$(129);:NEXT VDU1:PRINT
1210 VDU3
1220 ENDPROC
1230 REM***TO CHANGE TO MODE 0 DUMP**
1240 REM***1040 FOR D=0TO1279STEP14
1250 REM***1090 FOR X=(D+1)TO(D+14)STEP2

```

Calculator

By Simon Erhardt

```

: PRINT :
0 LET A$=""
0 LET B$=""
10 INPUT A$
20 IF A$="" THEN GOTO 10
30 IF A$="" THEN GOTO 10
40 IF A$="" THEN GOTO 10
50 IF A$="" THEN GOTO 10
60 IF A$="" THEN GOTO 10
70 IF A$="" THEN GOTO 10
80 IF A$="" THEN GOTO 10
90 IF A$="" THEN GOTO 10
9998 GOTO 9998
9999 RUN

```

POPULAR COMPUTING WEEKLY

19

Programming

A fast route to impressive Beeb graphics

Max Phillips describes how characters can be re-defined on the BBC micro

User defined characters provide a quick and easy route to fast, impressive graphics. Those complex animated displays, as used in *Space Invaders*, are possible without the need for assembly language sub-routines.

Different shapes may be assigned to any character — for example a lower case 'a' may be re-defined as a space invader or a ball. This facility exists on a number of machines, including the BBC micro.

To define a character for the BBC machine, draw an 8x8 grid and shade the squares you wish to appear in the current text colour when the character is printed. Each row of eight blocks can be thought of as an eight-bit binary number, a zero defines the unshaded square and one the shaded.

Figure 1 shows an invader character converted to eight such bytes in this way. Then each binary needs to be converted to decimal for use from within your Basic program. This is done by multiplying the first bit on the right by one and adding the next bit multiplied by two, the next by four, the next by eight and so on. This should give you your character defined by eight decimal numbers in the range 0 to 255.

To use your new character, pick which character in the computer's set you wish to re-define. For this you will need to know the Ascii code for that particular character.

■ your program the statement `VDU 23, A, N1, N2, N3, N4, N5, N6, N7, N8` will change the character whose code is 'A' to your character, where N1 to N8 are your eight numbers, starting from the top of the list. From this point on, printing that particular character, for example with `CHRS(A)`, will produce your character on the screen.

BBC Basic reserves characters 224 to 255 for your own definitions and you will need to use the PAGE command before you can safely change the other values.

Don't try to alter characters 0 to 31 or character 127. Notice that all characters are defined on this 6x8 grid but will be printed in slightly different proportions depending on which mode you use.

Program notes

If the above appears difficult or just time consuming, the program here allows you to define characters using the computer itself. It shows continuously the state of the grid, what the character will look like when it is printed and the eight decimal values needed to define the character.

When you run the program, the grid is shown by a red box with a white cursor inside. Next to this is the column of the numbers needed to define the character and below your character will appear as it is defined next to the words 'character is'.

Using the cursor (arrow) keys you can move the cursor to any point in the grid. Pressing D will colour that square yellow, move the cursor to the next square and automatically update the decimal.

Pressing O will turn a square that is 'on' back to 'off'. Note that you cannot turn 'on' a square that is 'on' or vice versa.

When your character looks how you want it, simply copy down the decimal. Pressing C allows you to start again and C

One useful trick in the program is the

x	00000000	$= 0$	x	0
x	00111100	$= 4+8+16+32 = 60$	x	60
x	01011010	$= 2+8+16+64 = 90$	x	90
x	00111100	$= 4+8+16+32 = 60$	x	60
x	00111100	$= 4+8+16+32 = 60$	x	60
x	01000010	$= 2+64 = 66$	x	66
x	00100100	$= 4+32 = 36$	x	36
x	00000000	$= 0$	x	0

Binary	Decimal
0000	0
0001	1
0010	2
0011	3
0100	4
0101	5
0110	6
0111	7
1000	8
1001	9
1010	10
1011	11
1100	12
1101	13
1110	14
1111	15



Figure 1: Converting a drawing into a character definition.

*FX 4.1 call which allows the GET function to read the arrow keys. Their normal function is restored when you quit the program with *FX 4.0.

Just to show what can be done in a few minutes, put your computer into MODE 5. Enter VDU 23,255,0,60,90,60,24,36,66,0 then PRINT STRING\$(20,CHR\$(255)). Think what could be done using different colours and several such characters!

Printing strings of your new characters is only one simple technique. Other suggestions are to overprint with slightly different versions of the same character, giving the impression of rotation or waving arms or to define a sequence of characters that are identical but shifted one square to the side.

Overprinting these will allow you to slide characters across character positions (you could of course put your characters anywhere by using the graphics cursor in conjunction with text cursor, try VDU 5).

Lastly, don't just stick at single characters, define bigger shapes by designing pairs of characters to be printed side by side. The list and the potential is endless.

[illegible]

Spectrum

In this new slot various contributors explore different aspects of the ZX Spectrum.

Who's a bright little flasher then?

Nick Hampshire continues his discussion of the ZX Spectrum colour commands.

The commands used to set up the colour and display attributes were examined in last week's article. Having used these commands to create a colour display there are a series of commands which can be used to control the way particular characters are displayed without actually altering the dot pattern or colours of each character space.

The first three of these commands are BRIGHT, INVERSE and FLASH.

The BRIGHT command will display the background colour of the printed string following the BRIGHT statement with an enhanced brightness. This means that it will stand out in relation to other displayed strings which are used without the BRIGHT command.

The number following the BRIGHT command determines whether it is turned on or off. A 0 and the "bright" is off. A 1 and the "bright" is on. The following is an example of a command using BRIGHT.

```
10 PRINT INK 0; PAPER 7; BRIGHT 1; "this is
    bright mode!"
20 PRINT INK 0; PAPER 7; BRIGHT 0; "the bright
    mode is turned off"
```

The INVERSE command simply reverses the foreground and background colours for the characters in the printed string after the INVERSE command. It does this without changing the dot pattern printed on the screen.

To turn the INVERSE command on it should be followed by a 1, and to turn it off it should be followed by a 0. The following is an example of the INVERSE command:

```
10 PRINT INK 0; PAPER 7; INVERSE 1; "characters
    are inverted"
20 PRINT INK 0; PAPER 7; INVERSE 0; "characters
    returned to normal"
```

The FLASH command is used to set a following character string to flash on and off between the normal screen display and the inverted display produced by the INVERSE command. The rate of flashing is about three times per second.

This command, like the previous two commands, is very useful in drawing attention to a displayed statement or command. The following is an example of the FLASH command:

```
10 INPUT FLASH 1; INK 1; PAPER 7; "input data"; N
```

The Spectrum has a very useful overprint-

```
10 REM test program
100 LET XC=100; LET Y0=20
105 LET DP=5; LET P1=1; LET P2=
110 FOR I=40 TO 70 STEP 10
115 REPEAT C
120 PAPER C
125 FOR Q=1 TO 10
130 LET DP=DP+5; 14159/180
140 LET P1=P1+3; 14159/180
150 LET P2=P2+3; 14159/180
155 FOR Y=P1 TO P2 STEP DP
160 LET X=Y+COS (P)
165 LET Y=Y+SIN (P)
170 LET X=X+X
175 LET Y=Y+Y
180 PLOT X,Y
185 NEXT Q
190 NEXT I
195 NEXT C
200 DATA 2,6,4,1,7
```

```
1 REM kinetic art program
2 REM fills the screen with a
  randomly
3 REM moving pattern of diffe-
  rent colour squares
4 REM just run and be hypnoti-
  sed
5 REM by the changing pattern
  s.
6 REM note that spaces are be-
  ing displayed
7 REM so the paper colour det-
  ermines display colour
8 RANDOMIZE
9 LET A=10; LET B=20
10 LET C=INT (RND*9)
20 LET N=INT (RND*20)
30 FOR X=0 TO N
40 LET D=INT (RND*4)
50 IF D=0 THEN LET A=A+1
60 IF D=1 THEN LET A=A-1
70 IF D=2 THEN LET B=B+1
80 IF D=3 THEN LET B=B-1
90 IF B=30 THEN LET B=30
100 IF B=1 THEN LET B=1
110 IF A=20 THEN LET A=20
120 IF A=1 THEN LET A=1
130 PAPER A
140 PRINT AT A,B; " "
150 NEXT X
155 GO TO 10
```

ing command called OVER which allows the creation of new characters by overprinting one or more characters over an existing character. The most obvious use of this command is to add an accent to a character.

Normally when a character is displayed, and another character previously occupies that space then whatever is already written in that character space is obliterated. In the OVER command the existing character is retained and the dots of the new character added.

As with the previous commands follow- ing it with a 1 will turn it on and a 0 will turn

it off. The following is an example of the OVER command:

```
10 OVER 1
20 PRINT "CHR$8";
```

The CHR\$8 causes the cursor to back up one character space. All the commands which control the attribute of a character can also be set using the character codes which represent the command; the following commands and codes are identical.

```
CHR$ 16 — INK command
CHR$ 17 — PAPER command
CHR$ 18 — FLASH command
CHR$ 19 — BRIGHT command
CHR$ 20 — INVERSE command
CHR$ 21 — OVER command
```

Hand & mouth



Who's playing the guessing game?

One of the cornerstones of the mathematical armoury necessary to deal with the everyday problems of a physicist, engineer or 'A' Level student is the ability to solve the roots of an equation. This has scope all the way from bridge building to understanding the origin of the universe. Don't let that put you off though, as I can do neither anyway.

Now, by root I mean any solution, X , to the equation $f(X)=0$. (That's why, incidentally, we call \sqrt{A} a square root, as that is the solution to the squared equation $f(X)=X^2-A=0$).

Nature rarely conspires to give us an exact functional form for the solution to such equations (such as the solution $aX^2 + bX + c = 0$; the well known $-b \pm \sqrt{b^2 - 4ac}$).

If you're out of luck then one of the techniques left at your disposal is the numerical solution. This crudely means

making successive guesses towards an answer which, if they are intelligently made, converge towards a solution.

Sounds easy? One root-finding numerical solution which is ideally suited to the modern programmable calculator was discovered over three hundred years ago by Isaac Newton — of falling apple fame. He showed that a good approximation to a zero in $f(X)$ and the difference term ΔX is given by $\Delta X = f(X)/f'(X)$ where $f'(X)$ is the differential of $f(X)$.

Now what this means to a good programmer is that if we generate a cyclic program to evaluate our new guess as $X - [f(X)/f'(X)]$ where X is the old guess, and repeat the procedure, then the sign of a root is ΔX (new guess-old guess) tending to zero.

If you are worried about $f'(X)$ remember that it can be approximated by $[f(X) - f(X-d)]/d$ where d is small, in many cases.

All too easy? Well, I'm afraid that I'd better spill some of the beans. First there is the problem that the calculator only carries internally some 10 to 13 digits (depending on the model) and hence we will introduce what are known as rounding errors owing to our non-exact evaluation of numbers.

For instance no calculator can solve $f(X) = X - (2[X-5]) = 0$ exactly by the above procedure even though the equation simplifies to $f(X) = 3X - 10$!

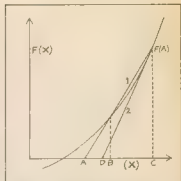
Another problem is that with only a finite amount of time available we can only give a finite number of guesses — and we can prove that in full generality we need to put in an infinite number of guesses.

another pseudo-op code called ORG (ORGin) in more than one place? ORG is used to set address at which the assembler will generate machine code. It is often useful to be able to alter the origin in the middle of the source code.

It is useful to be able to suppress the storage of the object code while the source is being assembled. This function allows you to check for assembly errors without actually producing any machine code. The second benefit is that you can check the size of the final object code program to make sure it will not overwrite your source code — a major disaster!

Does the assembler have good error messages when you are generating object code from source code? ZEN, for the Sharp M280K, has nine messages that may be triggered by faults.

How does the assembler link with the printer in your system? The Microtanic Software assembler will only print the source code when it is assembling. The ZEN assembler for the M280K computer had no print routine included when it was marketed first, only a space in the program where you could write your own routine.



Still, a good iteration program can usually overcome most of the problems — although it may be very complex to do so.

Anyway, there's an offer of £5 for the best program to generate the two roots of the equation $f(X) = \exp(X) - 5X + 3$ starting with initial guess 2.50; by some iteration other than the aforementioned Newton's Method. Perhaps you might take a hint from the above diagram.

Method One (Secant Iteration) — uses two guesses B and C to generate a third A and so on.

Method Two Newton's Method was, in fact, just the tangent to $f(X)$ at old guess $X=A$ to generate new guess D.

Generally, method one is faster than method two.

John Gowrie

When you have a working program will the assembler help you to generate machine code in a form suitable to be "blown" into an EPROM? You will need to be able to assemble the code at one address while the jump instructions are set for the eventual ROM address.

My EPROM programmer takes machine code from 0400 Hex. to 13FF Hex. If I want to produce an EPROM that will be placed at C000 Hex. the assembler must use an ORG instruction to start the machine code jump instructions at the right place while the code is actually stored at 0400 Hex.

I have not mentioned other features that you may encounter such as the ability to print the symbol table addresses or to sort them into alphabetical order. Nor have I gone into assembly from tape or disc rather than from the computer RAM.

The speed of assembly varies widely from one assembler to another and if you intend to write a long program, that may be important.

Next week I will write about macro assemblers and the difference one can make to the efficiency of the final object code.

John Dawson



Get yourself ORGANised!

When you have written the source code and stored it carefully, that means twice on different cassettes or discs, you come to the stage of turning all the lines of text, the mnemonics, into machine code that will run on your computer.

Generally you will spend far less time assembling a program than you will in preparation but there are, nevertheless, some important features to watch out for in this part of the assembler's functions.

Will the assembler allow you to use

Sound & vision



I look at all the lonely programs

The listing below is a simple program for playing Eleanor Rigby on the Vic-20. I have written it almost entirely with Pokes. I found it easier using Pokes, instead of Data statements, because there are so many repeated themes in the tune.

I listed the program on my school Pet

printer. To do this with Vic programs you need to:

- 1 SYS 1024
- 2 M 0400 0487
- 3 0400 00 01 10 00 00 BF 00 00
- 4 Press Return
- 5 Press K and Return

For Pets that cannot use machine code type:

POKE 4896,1:POKE 41,15 CLR

Neil Jayakumar

```

5 X=1
10 POKE36878,20
20 S=36876
30 POKES,183 FORT=1T0200:NEXTT:POKES,0
40 POKES,191 FORT=1T0200:NEXTT:POKES,0
45 POKES,199 FORT=1T0200:NEXTT:POKES,0
50 POKES,183 FORT=1T0400:NEXTT:POKES,0
60 POKES,167 FORT=1T0600:NEXTT:POKES,0
70 POKES,183 FORT=1T0200:NEXTT:POKES,0
80 POKES,191 FORT=1T0200:NEXTT:POKES,0
90 POKES,199 FORT=1T0200:NEXTT:POKES,0
100 POKES,207 FORT=1T0400:NEXTT:POKES,0
110 POKES,203 FORT=1T0200:NEXTT:POKES,0
115 POKES,199 FORT=1T0200:NEXTT:POKES,0
120 POKES,203 FORT=1T0400:NEXTT:POKES,0
130 POKES,199 FORT=1T0200:NEXTT:POKES,0
140 POKES,191 FORT=1T0200:NEXTT:POKES,0
150 POKES,199 FORT=1T0400:NEXTT:POKES,0
160 POKES,191 FORT=1T0200:NEXTT:POKES,0
170 POKES,183 FORT=1T0200:NEXTT:POKES,0
180 POKES,191 FORT=1T0400:NEXTT:POKES,0
181 X=X+1
190 POKES,183 FORT=1T0200:NEXTT:POKES,0
200 POKES,191 FORT=1T0200:NEXTT:POKES,0
210 POKES,199 FORT=1T0200:NEXTT:POKES,0
220 POKES,201 FORT=1T0600:NEXTT:POKES,0
230 POKES,199 FORT=1T0400:NEXTT
235 IFX<3THEN10
240 POKES,199 FORT=1T01600:NEXTT:POKES,0
250 POKES,212 FORT=1T0400:NEXTT:POKES,0
260 POKES,212 FORT=1T0200:NEXTT:POKES,0
270 POKES,212 FORT=1T0200:NEXTT:POKES,0
280 POKES,217 FORT=1T0200:NEXTT:POKES,0
290 POKES,219 FORT=1T0400:NEXTT:POKES,0
300 POKES,223 FORT=1T0400:NEXTT:POKES,0
310 POKES,219 FORT=1T0400:NEXTT:POKES,0
320 POKES,217 FORT=1T0400:NEXTT:POKES,0
330 POKES,212 FORT=1T0400:NEXTT:POKES,0
340 POKES,199 FORT=1T0400:NEXTT:POKES,0
350 POKES,183 FORT=1T0200:NEXTT:POKES,0
360 X=X+1
370 IFX<5THEN250
380 POKES,191 FORT=1T01600:NEXTT:POKES,0
390 FORZ=1TO8
395 POKES,199 FORT=1T0400:NEXTT:POKES,0
400 NEXTZ
410 FORZ=1TO8
420 POKES,201 FORT=1T0400:NEXTT:POKES,0
430 NEXTZ
440 POKES,175 FORT=1T0200:NEXTT:POKES,0
450 POKES,187 FORT=1T0200:NEXTT:POKES,0
460 POKES,195 FORT=1T0600:NEXTT:POKES,0

```

```

470 POKES,187 FORT=1T0400:NEXTT:POKES,0
480 POKES,195 FORT=1T0400:NEXTT:POKES,0
490 POKES,201 FORT=1T0200:NEXTT:POKES,0
500 POKES,187 FORT=1T0400:NEXTT:POKES,0
510 POKES,175 FORT=1T0400:NEXTT:POKES,0
    FORT=1T0600:NEXTT
520 POKES,201 FORT=1T0200:NEXTT:POKES,0
530 POKES,215 FORT=1T0400:NEXTT:POKES,0
540 POKES,201 FORT=1T0400:NEXTT:POKES,0
550 POKES,195 FORT=1T0500:NEXTT:POKES,0
    FORT=1T0150:NEXTT
560 POKES,187 FORT=1T0400:NEXTT:POKES,0
570 POKES,175 FORT=1T01400:NEXTT:POKES,0
    FORT=1T0400:NEXTT
575 X=10
580 POKES,215 FORT=1T01200:NEXTT:POKES,0
590 POKES,219 FORT=1T0200:NEXTT:POKES,0
600 POKES,221 FORT=1T0200:NEXTT:POKES,0
610 POKES,225 FORT=1T0400:NEXTT:POKES,0
620 POKES,221 FORT=1T0400:NEXTT:POKES,0
630 POKES,219 FORT=1T0400:NEXTT:POKES,0
640 POKES,215 FORT=1T0400:NEXTT:POKES,0
650 POKES,201 FORT=1T0400:NEXTT:POKES,0
660 POKES,187 FORT=1T01200:NEXTT:POKES,0
670 X=X+1
680 IFX<12THEN580
690 FORT=1T0200:NEXTT
700 POKES,175 FORT=1T0200:NEXTT:POKES,0
710 POKES,183 FORT=1T0200:NEXTT:POKES,0
720 POKES,187 FORT=1T0400:NEXTT:POKES,0
730 POKES,195 FORT=1T0200:NEXTT:POKES,0
740 POKES,201 FORT=1T0400:NEXTT:POKES,0
750 POKES,201 FORT=1T0200:NEXTT:POKES,0
760 POKES,207 FORT=1T0200:NEXTT:POKES,0
770 POKES,212 FORT=1T0200:NEXTT:POKES,0
780 POKES,201 FORT=1T0400:NEXTT:POKES,0
790 POKES,191 FORT=1T0600:NEXTT:POKES,0
800 POKES,201 FORT=1T0200:NEXTT:POKES,0
810 POKES,207 FORT=1T0200:NEXTT:POKES,0
915 POKES,212 FORT=1T0200:NEXTT:POKES,0
820 POKES,219 FORT=1T0400:NEXTT:POKES,0
930 POKES,217 FORT=1T0200:NEXTT:POKES,0
940 POKES,217 FORT=1T0400:NEXTT:POKES,0
950 POKES,212 FORT=1T0200:NEXTT:POKES,0
960 POKES,207 FORT=1T0200:NEXTT:POKES,0
970 POKES,212 FORT=1T0400:NEXTT:POKES,0
980 POKES,207 FORT=1T0200:NEXTT:POKES,0
990 POKES,201 FORT=1T0200:NEXTT:POKES,0
900 POKES,207 FORT=1T02100:NEXTT:POKES,0
310 RUN

```




Keyboard Audio Tone

Audio Keystroke and Program Monitor

- **TWO TONE** One to indicate initial press of key, the second tells you when computer is ready to accept next entry (very useful when entering long program listing)
- Indicates start and finish of running programs, and start and end of SAVE and LOAD routines
- Indicates Keyboard entry during INPUT prompts
- Use to indicate progress of running programs, or for sound effects in games programs, by including short PAUSE in listing
- Operates in FAST and SLOW modes, with normal or shifted keys
- Only five simple connections to ZX81 P.C.B.

Supplied ASSEMBLED complete with fitting instructions or factory fitting service available by sending us your ZX81 only (NOT power supply)

£8.95 inc vat ASSEMBLED

£10.95 inc vat + 90p P & P FACTORY FITTED

Cheques and P.O.s payable to:
TV SERVICES OF CAMBRIDGE LTD
CHESTERTON MILL
FRENCH'S ROAD
CAMBRIDGE CB4 3NP
Tel: (0223) 358366

POPULAR Computing WEEKLY

HOBHOUSE COURT, 19 WHITCOMB STREET WC2

WHY NOT TAKE OUT A SUBSCRIPTION?

You can have *Popular Computing Weekly* sent to your home for £19.95 a year. This will cover the cost of the magazine, postage and packing.

Fill in the coupon below and keep yourself up to date week by week.

I would like to take out subscription(s) ☒ *Popular Computing Weekly*.

Name

Address

Tel No.

I enclose £..... for subscription(s).

Please make cheques payable to Sunshine Publications Ltd.

Peek & poke

Peek your problems to our address. Ian Beardmore will poke back an answer.

SINCLAIR: PLEASE LET THE GOOD TIMES ROLL

Philip Lee of Charmaine Court, Harlington, Middlesex writes:

Q After a two-month delay, Sinclair Research has finally delivered five rolls of printer paper ordered in February. I have been wondering if there is any way to speed up delivery, or is there an alternative supplier? If not I might as well order my next batch now.

A Unfortunately there is not much that you can do other than order your next rolls now. An alternative supplier did come forward last September, but the rolls supplied simply did not print. Since then, as far as I know, no one else has ventured into this section of the ZX market.

KEEP A WELCOME IN THE RAM PACK

Richard Haunton of Hitches, Petworth, Sussex, writes:

Q I am in a slight fix. I am going away to live in Wales, and I have a Welsh pen friend. I wondered if you could write a program for the ZX81, with 16K RAM Pack, to convert English to Welsh, and Welsh to English.

I would like it to work by feeding in sentences and translating them. I hope that you can help. I know that you can buy computers that can translate eight languages. I only want one.

A In programs such as this the available memory is the point which must be borne in mind. The program here is adapted from an English/Dutch glossary I wrote some time ago. Phrases and sentences consume a lot more memory, but I cannot say how much as I do not know what you actually want to put in.

It is because of space that I have used lines 30 and 40 in the way that I have. If you find that you can lower the value of P in line 40 all to the good.

Remember that spaces must be included in the same place each time. In the lines from

3010 on I have separated the two complete phrases by a comma.

You will probably find that different line lengths need different spacings. This is something you can only do when the lines are on the screen in front of you. Because of the line numbering, the English phrase at 1010 is the translation of the Welsh phrase at 3010 and they are printed at 3010.

This system follows all the way through, and should make it easier to enter the program.

```
10 REM TRANSLATION PROGRAM
20 REM 1 BEARDSMORE
30 LET Q=1
40 LET P=9
50 PRINT "ENGLISH (E) WELSH (W) STOP (S)"
60 INPUT AS
70 IF AS="E" THEN GOTO 100
80 IF AS="W" THEN GOTO 200
90 IF AS="S" THEN STOP
100 PRINT "INPUT ENGLISH PHRASE"
110 INPUT ES
120 GOTO 1000
200 PRINT "INPUT WELSH PHRASE"
210 INPUT WS
220 GOTO 2000
1000 FAST
1010 IF ES(1) TO P1="first nine letters and spaces of first English phrase" THEN GOTO 3010
1020 IF ES(1) TO P1="first nine letters and spaces of second English phrase" THEN GOTO 3020
Input all the English phrases in the same way
2000 FAST
2010 IF WS="first nine letters and spaces of first Welsh phrase" THEN GOTO 3010
2020 IF WS="first nine letters and spaces of second Welsh phrase" THEN GOTO 3020
Input all the Welsh phrases in the same way
3010 PRINT "first English phrase" "first Welsh phrase"
3015 GOTO 50
3020 PRINT "second English phrase" "second Welsh phrase"
3025 GOTO 50
```

IS THERE A HEX ON THIS PROGRAM?

S. A. Chowdhury of Tooting Bec Road, London, writes:

Q I am the owner of a ZX81 and I have just received a program for Space Invaders. The bulk of the program is written in hexadecimal. I have tried many times to enter it, but after a few

bytes the computer gives back the report 4/150. Please could you tell me where I am going wrong?

A I cannot give you any advice about the program as such, because you do not say which Space Invaders it is. Anyway in a case like this it would be best to get in touch with whoever you got the program from.

They will have the correct listing to hand, whereas anyone else would probably have to spend many hours working it out.

It does strike me that you have made, what is in fact a common mistake. How many K does the program require? The error code, 4/150 means that you have run out of memory at line 150.

It is probable that if you have a ZX81, without a RAM Pack and the 1K onboard RAM is not enough. If this is the case then one of the several 16K RAM packs that are on the market should take care of this.

HIS PROBLEM IS INDEX-LINKED

R. R. Williams of Menai Bridge, Gwynedd, writes:

Q I would be grateful for your help and comments with regard to the possibility of using the ZX81 for the purpose of indexing.

The project I have in mind is to index from a text as follows:

- a indexing personal names with a reference number in alphabetical order;
- b indexing place names with a reference number in alphabetical order;
- c indexing status and profession with a reference number in alphabetical order;
- d indexing of ships names with a reference number;
- e indexing of special personal names in alphabetical order;
- f indexing of miscellaneous items in alphabetical order.

My purpose is to call up the information, say a, and print it. I do not want to computer store the information since the printed material

is my final information. I would prefer to be able to print on A4 paper in two columns.

We have an electronic Silver Reed EX55 typewriter with a daisy-wheel capable of 20 cps. Can you also say if a suitable interface can be purchased for this machine to act as a printer for the ZX81?

A You are looking for an indexing program for the ZX81 and surprisingly there seem to be very few published.

I feel your best bet would be to look at *Byting Deeper Into Your ZX81* by Mark Harrison. On page 47 there's an indexing program along with a good, concise description of how it works. The book is published by Sigma Press and is available from Dillons University Bookshop in Mallet Street, London WC1. Price £4.95 plus p&p.

However on reading the second part of your letter, I think you should take a close look at the ZX81, and what it can do. It is a computer, not a word processor. While many micros will have the facilities that you need (including the new ZX Spectrum), I do not think that the ZX81 is among them.

Most obvious drawback is the print-out. Amidst the plethora of add-ons for the ZX81, I have never seen a conventional paper printer. The ZX81 doesn't even have lower case letters (though d/k trionics do have an add-on 4K ROM chip that includes lower case letters) which might overcome this problem.

The problem for you is that the ZX81 can do the task you want it to do, but it cannot process the information in the way you want it — on A4 paper.

It is a task that seems ideally suited to a micro, and if you want to use one, then perhaps you should look at other systems.

● Stop agonising over that problem. Write to Ian Beardmore, Peek & Poke, Popular Computing Weekly, Highbury Court, 19 Whitcomb Street, London WC2H 7HF.

Competitions

Puzzle No 8

You will need a chess-board, two dice and a supply of counters.

Throw the two dice and note the numbers uppermost. This represents the throw for the game and the dice are not rethrown.

Starting at the bottom left of the chess-board (counting the corner square as number 1) count off the number shown by the first die, moving across the bottom row till the board, from left to right.

When the first number thrown is reached, place a counter on this square, and continue counting, only this time the number on the other die. Once again place a counter to mark the square on which you land.

If you reach the end of the row, then move up on to the second line and continue, this time moving from right to left — rather in the manner of moves in a game of Snakes and Ladders.

Then continue up the board by counting again the number of the first die, then the second — always alternating the two numbers. Each time you land put down a counter so you will leave a trail of counters showing the squares on which you landed.

Now, when you arrive at the top left-hand square, without interrupting the sequence of counting, turn and continue down the left-hand file of the board and proceed by zig-zagging up and down the board until you finally reach (or pass over) the top right-hand square.

On this second (up and down) stage, although you continue to place counters on vacant squares, if you land on a square that already has a counter on it, you must take that counter off the board (ie this square becomes vacant). The total number of counters remaining

on the board represents the 'score' for that particular throw of the dice.

- (a) Which dice give the lowest score?
(b) Which dice give the highest score?
(c) Which two throws produce an identical final arrangement of counters that form an almost perfect "enlarged" chequered pattern?

Solution to Puzzle No 4:

755
x33

2325
2325

25575

Winner of Puzzle No 4

The winner is: R. G. Girvan, Gillott Road, Edgbaston, Birmingham, who receives £10.

Solution to Crossword No 4

Across: 4 Gosub 7 Display 8 Access 10 Cream 12 Edam 13 Experts 14 Thor 15 Sigma 16 Apples 20 Unbound 21 Store.

Down: 1 Microchip 2 Speakers 3 Wax 5 Orc 6 Use 8 Acorn 9 Statement 11 Spies 13 Eskimos 17 Pet 18 Ear 19 One.

Winner of Crossword No 4

The winner is: A. E. Lewis, St John's Place, Rhosce, Nr Barry, Glamorgan, who gets £10.

Rules

The winner for the crossword and the winner of the puzzle will be the first name out of the hat (in each case).

Closing date for both the crossword and the puzzle is Monday, 28 June.

Please mark your envelope 'CROSSWORD' or 'PUZZLE'.

Crossword No 8



ACROSS

- 4 Current or not, start with the micromaker (5)
- 7 Parent with cage containing a king is the subject of a complete computer system (7)
- 8 Set on a rail, I hear (5)
- 10 Age after a thousand million, wide mouthed (5)
- 12 Total money for an oil pan (4)
- 13 Level, not odd, not in (4, 3)
- 14 Turn and strike in the stomach (4)
- 15 Armed with upper-class people (5)
- 16 Prises a student, always (8)
- 20 Digits — the Frenchman's end, the German's hall, and the Spanish start (7)
- 21 Width of a display device (5)

DOWN

- 1 Close micro maker (8)
- 2 Jumped and missed (7)
- 3 For example, loss of a suit-image (3)
- 5 Stop the upcoming union meeting (3)
- 6 Crowded valley in safari area (3)
- 8 A right note on matter of 170 (5)
- 9 170's former officer (6)
- 11 In state of great exasperation (5)
- 12 Bunches of cylinders in basic threads (7)
- 13 Micro No 5897 (3)
- 18 Statement on passing test (3)
- 19 Basic statement about a basic function (5)

CITIZEN PAIN

BY DAVID IRELAND and JAMES MACDONALD

PEOPLE DROPPING BY AT THEIR JOB CENTRE...

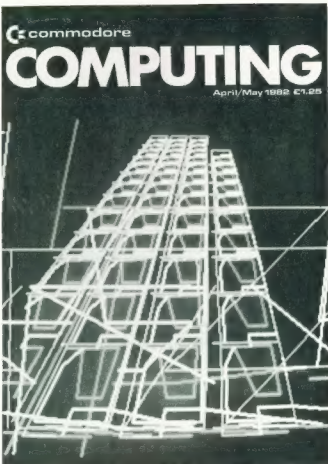


VOICE-PRINT TEST



MUG SHOT...





An exciting new Commodore peripheral

Own or use a Pet or a Vic?
Fed up with being ignored by all the traditional monthly magazines?
Fed up with listings, which are too simple or simply do not work?
You need *Commodore Computing*, the new monthly magazine. *Commodore Computing* is published by Nick Hampshire, author of *The Pet Revealed*, *Pet Graphics*, *A Library Subroutines* and *The Vic Revealed*.
Each issue is packed with advanced

advice on how to make the most of your computer, whether you use a Pet or a Vic.
Each issue covers a host of applications – software, hardware, machine code, games, business use – whatever it is you'll find it in *Commodore Computing*.
If you want to learn more about your computer, take out a subscription to *Commodore Computing*.
That's the only way to get it, and get it straight.

Send £12.50 for 1 year's subscription (10 issues) to:

Commodore Computing,
Magsub, Oakfield House, Perrymount Road, Haywards Heath, Sussex RH16 3DH

ZX Users' Club

JOIN YOUR USERS' GROUP — AND MAKE THE MOST OF YOUR MICROCOMPUTER

Join the National ZX80 and ZX81 Users' Club, by subscribing to the official monthly club magazine **INTERFACE**.

- () Please send me the next 12 issues of **INTERFACE**, containing many programs for each machine in each issue, plus hints, tips, software, hardware and book reviews, plus special offers for members. I understand you will be able to help me with problems regarding my computer, and let me know of any local branches of the club in my area. I enclose **£9.50** (UK), **£12.50** (Europe) or **£16.00** (elsewhere).

Please send me the following books:

- () **GETTING ACQUAINTED WITH YOUR ZX81** — by Tim Hartnell — **£5.95**. This great ZX81 book contains over 80 programs in its 128 pages. Takes you from the first steps of programming your ZX81 to quite complex programs such as **WORD PROCESSOR**, **DRAUGHTS** and **LIFE**. You'll find a host of programs to get your ZX81 up and running with worthwhile programs, right from day one. Other programs include **SPACE BOY**, **ROLLER-BALL**, **CHEMIN DE FER**, **GRAFFITI**, **MICRO-MOUSE**, **POGO**, **TOWERS OF HANOI**, **BLOCKOUT**, **SALVADOR**, **BANDIT** and **DODGE CITY**.

As well as programs, there are sections to explain the use of **PLOT**, **UNPLOT**, **PRINT AT**, **MAKING THE MOST OF 1K**, **ARRAYS**, **WRITING PROGRAMS**, **BIO-RHYTHMS**, **ARCADE GAMES**, **RANDOM NUMBERS**, **PEEK AND POKE**, **HOW TO CONVERT PROGRAMS**, **USEFUL ADDRESSES**, **SPECIFICATIONS**, **THE NEW ROM**.

- () **THE GATEWAY GUIDE TO THE ZX81 AND ZX80** — by Mark Charlton — **£6.45**. Explains **ZX BASIC** from first principles. 180 pages, more than 70 programs. Recommended by **Creative Computing**.
- () **MASTERING MACHINE CODE ON YOUR ZX81 OR ZX80** — by Tony Baker — **£7.50**. Warmly welcomed by the computer press, this book has continued to attract praise, because it does exactly what it claims to do in the title.
- () **49 EXPLOSIVE GAMES FOR THE ZX81** (and 29 for the ZX80) — edited by Tim Hartnell — **£5.95**. Every game you need: **DRAUGHTS**, **GALACTIC INTRUDERS**, **STAR TREK**, **DEATH MAZE**, **4-IN-A-ROW** and an **8K ADVENTURE**-type program **SMUGGLERS BOLD**.
- () **34 AMAZING GAMES FOR THE 1K ZX81** — by Alastair Gourlay — **£4.95**. All programs dumped from the printer and guaranteed to run. This book is the key to making the most of 1K.
- () **GETTING ACQUAINTED WITH YOUR VIC20** — by Tim Hartnell — **£6.95**. This book is the ideal one for first-time users of the **VIC 20**, with over 60 programs.
- () **SYMPHONY FOR A MELANCHOLY COMPUTER** and other programs for the **VIC20** — **£6.95**. A great collection of 24 great games — all dumped direct from the printer — for the **VIC20**.
- () **GETTING ACQUAINTED WITH YOUR ACORN ATOM** — by Trevor Sharples and Tim Hartnell — **£7.95**.
- () **39 TESTED PROGRAMS FOR THE ACORN ATOM** (the best of **INTERFACE**) — **£6.45**.
- () **PASCAL FOR HUMAN BEINGS** — Jeremy Ruston — **£4.95**.

Atom
VIC

INTERFACE,

44-46, Earsl Court Road, Department PC, London W8 6EJ.

Please send me the indicated items. I enclose £-----.

Name -----

Address -----

